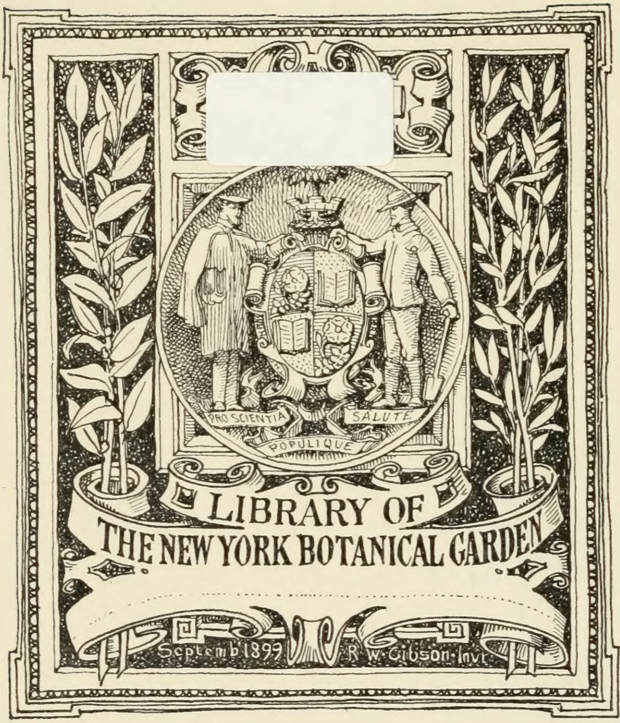


LIBRARY OF
THE NEW YORK BOTANICAL GARDEN

NEW YORK
BOTANICAL GARDEN.

TWENTY-FIFTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN.

FROM

OCTOBER 1, 1885, TO SEPTEMBER 30, 1886.

BY AUTHORITY.

LANSING:
THORP & GODFREY, STATE PRINTERS AND BINDERS.
1886.

X A
.N 7772
V. 25

LIBRARY
NEW YORK
BOTANICAL
GARDEN

REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

AGRICULTURAL COLLEGE,
October 1, 1886.

To RUSSELL A. ALGER,
Governor of the State of Michigan:

SIR,—I have the honor to submit to you herewith as required by statute the accompanying annual report for the year ending September 30, 1886, with supplementary papers.

Very respectfully,
HENRY G. REYNOLDS,
Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

Hon. FRANKLIN WELLS, of Constantine,

PRESIDENT OF THE BOARD.

Hon. THOMAS D. DEWEY, of Owosso,

VICE PRESIDENT.

Hon. WM. B. McCREERY, of Flint,
Hon. ELIJAH W. RISING, of Davison Station,
Hon. HENRY CHAMBERLAIN, of Three Oaks,
Hon. CYRUS G. LUCE, of Gilead,

Hon. RUSSELL G. ALGER, Governor of the State,
Hon. EDWIN WILLITS, M. A., President of the College.
Ex Officio.

HENRY G. REYNOLDS, Secretary, Agricultural College.
MERRITT L. COLEMAN, Treasurer, Lansing.

FACULTY AND OFFICERS OF THE STATE AGRICULTURAL COLLEGE.

Edwin Willits, M.A., President and Professor of Political Science, Constitutional Law and Business Law.

Theophilus C. Abbot, LL. D., Professor of Mental Philosophy and Logic.

Robert C. Kedzie, M.A., M.D., Professor of Chemistry and Curator of the Chemical Laboratory.

Albert J. Cook, M.D., Professor of Zoölogy and Entomology and Curator of the General Museum.

Wm. J. Beal, M.S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum.

Rolla C. Carpenter, M.S., C.E., Professor of Mathematics and Civil Engineering.

Samuel Johnson, M.S , Professor of Practical Agriculture and Superintendent of the farm.

Elias J. MacEwan, M.A., Professor of English Language and Literature.

E. A. A. Grange, V.S., Professor of Veterinary Science.

John A. Lockwood, 2nd Lieut. 17th U. S. Infantry, Professor of Military Science and Tactics.

Liberty H. Bailey, Jr., M.S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department.

Lewis McLouth, M.A., Ph. D., Professor of Mechanics and Astronomy.

Henry G. Reynolds, M.S., Secretary.

Frank S. Kedzie, M.S., Assistant Professor of Chemistry.

Louis G. Carpenter, M.S , Assistant Professor of Mathematics.

Henry R. Pattengill, Assistant Professor of English.

Joseph B. Cotton, B.S , Instructor in Mathematics.

Mrs. Mary J. C. Merrell, M.S., Librarian.

Henry W. Baird, B.S., Assistant Secretary.

Hiram T. French, B.S., Foreman of the Farm.

Louis Knapper, Florist.

Charles S. Crandall, B.S., Foreman of the Horticultural Department.

James Wiseman, Engineer and Foreman of Iron Shops.

H. Campbell, Carpenter and Foreman of Wood Shops.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE YEAR ENDING SEPTEMBER 30, 1886.

SECRETARY'S ACCOUNT.

		Dr.	Cr.
To balance on hand October 1, 1885		$468 46	
To balance on deposit with College Treasurer October 1, 1885, less two warrants outstanding ($19,309.04 less $843.34)		18,475 70	
To State Treasurer on account special appropriations—			
Farm Department	$2,810 00		
Garden	232 00		
Greenhouse	695 00		
Botanical	400 00		
Chemical	1,500 00		
Zoological	750 00		
Mechanical	9,000 00		
Repairs of buildings	1,647 00		
Steam repairs	600 00		
Mathematics	225 00		
Institutes	300 00		
Library	1,700 00		
Students' labor	4,000 00		
	$23,859 00		
To receipts of Institution on account of lspecial appropriations—			
Library	$2 50		
Mechanical department	2 00		
Steam repairs	31 44		
	$35 94		
To receipts transferred to special appropriation account—			
Library special examination fees	$98 00		
Assembly Hall, bank interest	306 99		
Assembly Hall, matriculation fees	745 00		
Assembly Hall, diploma fees	80 00		
	$1,229 99		
Total receipts on account special appropriations		25,124 93	
Carried forward		$44,069 09	

			Dr.	Cr.
Brought forward			$44,069 09	
To State Treasurer on account of current expense—				
Interest	$29,920 68			
		$29,920 68		
To sundry receipts of institution on account current expense—				
Farm department	$6,425 10			
Horticultural department	682 22			
Greenhouse department	311 20			
Apiary	57 13			
Fuel	226 42			
Fertilizer license fees	300 00			
Range rent of boarding clubs	100 00			
Miscellaneous receipts less $306.99, bank interest transferred to special appropriation account	146 80			
		8,248 87		
To receipts from students' fees on account of current expense—				
Room rent	$2,779 93			
Incidental expense fee	1,750 75			
Damages	28 27			
Physiology class fee	15 00			
Chemistry class fee	546 41			
Matriculation, diploma, and special examination fees, transferred to special appropriation account	----------			
		5,120 36		
Total receipts on account of current expense			43,289 91	
To students' deposits			1,327 49	
By students' deposits, balance of previous year, paid			----------	$1,779 00
By disbursements on special appropriation accounts			----------	33,478 17
By disbursements on current expense accounts			----------	43,945 75
By balance on deposit with college treasurer Oct. 1, 1886			----------	7,636 89
By balance cash on hand October 1, 1886			----------	1,846 68
			$88,686 49	$88,686 49

SUMMARY OF TREASURER'S REPORT.

M. L. Coleman in account with Agricultural College.

	Dr.	Cr.
To balance October 1, 1885	$19,319 04	
To receipts from State Treasurer and Secretary State Board of Agriculture from October 1, 1885, to September 30, 1886,	67,656 14	
By warrants paid from October 1, 1885, to September 30, 1886	----------	$79,338 29
Balance to new account October 1, 1886	----------	7,636 89
	$86,975 18	$86,975 18

The above is a correct summary of my report to the State Board of Agriculture.

M. L. COLEMAN, *Treasurer.*

SUMMARY OF DISBURSEMENT ACCOUNT.

Disbursements on account of special appropriations—		
Farm department	$2,879 69	
Horticultural department	279 48	
Greenhouse department	324 36	
Botanical department	754 68	
Veterinary department	5,840 24	
Chemical department	1,638 93	
Zoological department	1,264 55	
Mechanical department	8,070 20	
Repairs of buildings	1,323 35	
Steam repairs	603 38	
Mathematical department	371 03	
Farmers' Institutes	335 14	
Drill room and armory	3,989 95	
Library	2,474 27	
Students' labor	2,980 84	
Water works	37 49	
Mechanical tools	17 59	
Experiments in ensilage feeding, etc.	293 00	
		$33,478 17
Disbursements on account of current expense—		
Salaries	$26,281 05	
Farm department	4,721 90	
Horticultural department	1,840 96	
Mechanical department	1,478 06	
Greenhouse department	408 84	
Steam, fuel and lighting	3,900 45	
Repairs and janitor work	1,959 92	
Chemical laboratory	373 73	
Military department	342 66	
Sundry academic department	588 63	
Catalogues, postage, offices and Sunday services	1,038 95	
State Fair exhibition	262 45	
Miscellaneous incidental expenses	748 15	
		43,945 75
		$77,423 92

ACCOUNT WITH FARM DEPARTMENT.

	Dr. To Disbursements.	Cr. By Receipts.
On account of—		
Labor	$1,432 59	$4 02
Farm house	799 66	458 62
Team	165 00	3 40
Cattle	1,653 13	4,337 96
Sheep	82 74	302 82
Swine	16 09	162 70
Grain	79 12	886 48
Seeds	151 41	97 33
Wood	88 05	150 73
Implements and repairs	202 38	21 04
Office, etc.	51 73	
Balance, credit for year	1,703 20	
	$6,425 10	$6,425 10

ACCOUNT WITH HORTICULTURAL DEPARTMENT.

	DR. To Disbursements.	CR. By Receipts.
On account of—		
Grounds and labor	$548 38	
Board of men	262 28	
Team	382 79	
Vegetable garden and fertilizers	249 99	
Orchard, fruit garden and vineyard	138 02	
Implements, repairs, etc.	137 87	
Ice	47 49	
Office	74 14	
Sundry receipts		$682 22
Balance to debit for year		1,158 74
	$1,840 96	$1,840 96

SALARIES.

The salaries now paid are as follows:

President	$3,200 00
Two Professors @ $2,000 each	4,000 00
Six Professors @ $1,800 each	10,800 00
One Professor @ $1,500	1,500 00
One Professor @ $1,400	1,400 00
One Professor @ $1,200	1,200 00
Two Assistant Professors @ $1,000 each	2,000 00
One instructor @ $500	500 00
Secretary	500 00
Assistant Secretary	600 00
Librarian	600 00
Foreman of farm department (including board)	750 00
Foreman of horticultural department	750 00
Florist	750 00
Engineer	700 00
	$29,250 00

SUMMARY OF INVENTORY, SEPTEMBER 30, 1886.

College farm and park, 676 acres, @ $70		$47,320 00
Buildings—		
College hall	$15,000 00	
Williams hall	45,000 00	
Wells hall	25,000 00	
Library and museum building	25,000 00	
Chemical laboratory	18,000 00	
Botanical laboratory	6,000 00	
Mechanical laboratory	7,800 00	
Veterinary laboratory	5,400 00	
Armory and assembly hall	6,000 00	
Farm house	3,500 00	
Four brick houses @ $3,000	12,000 00	
Two brick houses @ $3,500	7,000 00	
President's and two frame houses	20.728 00	
One frame house	4,000 00	
Herdsman's house	600 00	
Nine barns at Professors' houses, @ $300	2,700 00	
Horticultural barn and shed	1,100 00	
Cattle barn and shed	3,400 00	
Sheep barn	2,500 00	
Horse barn	3,000 00	
Piggery	2,000 00	
Brick work-shop	600 00	
Corn-house	500 00	
Green-house	9,500 00	
Feed barn	1,150 00	
Grain barn	1,600 00	
Tool-house	1,300 00	
Observatory	150 00	
Boiler-house and fixtures	5,000 00	
Bee-house	280 00	
		235,808 00
Water works		4,690 00
Steam works—		
Four boilers @ $600.00	$2,400 00	
Underground piping	2,700 00	
Pipes and fittings	461 38	
Tools for steam fittings	302 02	
		5,863 40
Twelve fire extinguishers		500 00
Fuel on hand		903 00
Ice tools and pile-hammer		43 00
Farm Department—		
Cattle	$18,150 00	
Horses	1,400 00	
Sheep	1,389 00	
Swine	893 00	
Implements, produce, etc.	7,530 74	
Horticultural Department—		29,362 74
Team, harness, etc.	$518 00	
Tools	655 06	
Vegetable garden	301 15	
Office	33 05	
Compost and manure	60 00	
Miscellaneous	50 25	
Green-house—		1,617 51
Plants	$3,300 00	
Furnaces	300 00	
Miscellaneous	400 00	
Mechanical department—		4,000 00
Tools in wood shop	$789 99	
Tools in iron shop	2,977 06	
Stock for repairs	94 60	
		3,861 65
Footing carried forward		$333,969 30

INVENTORY.

Brought forward		$333,969 30
Chemical Department—		
Furniture and fixtures	$461 00	
Physical apparatus	6,411 00	
Chemical apparatus and chemicals	4,399 50	
		11,271 50
Engineering Department—		
Surveying instruments, etc.		1,222 20
Physical apparatus—		
Telescope, etc		1,560 00
Botanical Department—		
Museum	$4,154 00	
Microscopes and other apparatus	1,457 50	
Furniture and fixtures	80 50	
		5,692 00
Library—		
Books and pamphlets	$18,430 00	
Furniture	1,415 00	
		19,845 00
General museum—		
Collections and cases		11,660 00
College Hall—		
Furniture		863 50
Williams' Hall—		
Furniture		638 48
Secretary's office		382 80
President's office		240 45
Apiary—		
Bees, stock and apparatus		508 50
		$387,853 73

A SUMMARY OF THE RESOURCES OF THE MICHIGAN AGRICULTURAL COLLEGE.

Farm, buildings, and equipments, as per above inventory	$387,853 73
Agricultural College trust fund from sale of lands of United States grant	301,333 58
Balance due on purchase money “ “ “ “ “ “	134,234 31
124,242.91 acres @ $5 per acre yet unsold “ “ “ “	621,214 55
920 “ “ “ “ “ “ “ of swamp land grant	4,600 00
Total	$1,449,236 17

The present amount of the trust fund. is taken from the last line (that for 1886) of the fifth column of Table No. 2, page xiii.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the College lands have been sold up to the present time, *i. e.:*

The total of the tenth column in Table No. 1	$466,553 37
Less the payments made on these sales, constituting the trust fund	301,333 58
	$165,219 79
And less balances due on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in column eleven of Table No. 1	30,985 48
	$134,234 31

The 124,242.91 acres yet vacant of the U. S. land grant are given in detail as located in the different counties in Table No. 6.

The 920 acres of swamp land is what still remains unsold of a grant from the State to the College of swamp lands located in the townships of Lansing and Meridian in Ingham county, and Bath and De Witt in Clinton county.

TABLE No. 1.—*Agricultural College Lands, United States Grant, Record of Sales and Forfeitures to the Present time.*

	Number of Acres sold at Original Sale.			Forfeited Lands Resold.			Total Sales.			Number of Acres Reverting by Forfeiture.	Aggregate of Sales, less Forfeitures to end of each Year. Acres.	Balance Remaining Vacant at end of each Year. Acres.
Year.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.	Acres.	Average Price Per Acre.	Amount.			
1867												235,682.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,162.46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,682.46
1870	3,280.	3 44	11,280 00				3,280.	3 44	11,280 00		17,280.	218,402.46
1871	9,372.44	3 37	31,637 32				9,372.44	3 37	31,637 32		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,419.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438 58	171,243.88
1874	2,039.95	3 20	6,519 75	40.	3 00	120 00	2,079.95	3 19	6,639 75	638.72	65,879.81	169,802.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,523.66
1876	1,953.73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 39	8,381 19	1,758.40	70,874.13	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415.73	74,025.62	161,656.84
1879	6,782.12	3 02	20,506 36	1,318.06	3 08	4,054 18	8,100.18	3 03	24,560 54	1,978.11	80,147.69	155,534.77
1880	8,826.56	3 03	26,729 58	280.	3 18	890 00	9,106.56	3 03	27,619 58	4,926.33	84,327.92	151,354.54
1881	6,168.97	3 96	24.447 25	360.	4 33	1,560 00	6,528.97	3 98	26,007 25	1,987.19	88,869.70	146,812.76
1882	10,225.99	5 00	51,129 95	1,637,01	5 09	8,335 05	11,863.	5 01	59,464 90	760.11	99,972.59	135,709.87
1883	7,035.57	5 00	35,177 85	1,680.	5 03	8,448 00	8,715.57	5 00	43,625 85	560.	108,128.16	127,554.30
1884	1,846.01	5 09	9,390 05	526.45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 60	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.00	5 83	4,200 00	560.	5 78	3,240 00	1,280.00	5 81	7,440 00	440.	111,439.55	124,242.91
Total	121,210 90	$3 54	$428,807 61	8,456.77	$4 46	$37,745 73	129,667.67	$3 60	$466,553 37	18,228.12		

TABLE NO. 2.—*Agricultural College Trust Fund.*

Year.	Receipts of State Land Office on account of Principal for Agricultural College Lands sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College Trust Fund.	Aggregate to credit of Agricultural College Trust Fund at close of each fiscal year.
1868	$2,300 00	----------	$2,300 00	----------
1869	11,865 00	----------	11,865 00	$14,165 00
1870	5,895 00	----------	5,895 00	20,060 00
1871	20,101 53	----------	20,101 53	40,161 53
1872	33,621 93	$174 54	33,447 39	73,608 92
1873	29,583 47	----------	29,583 47	103,192 39
1874	4,686 75	----------	4,686 75	107,879 14
1875	5,399 24	----------	5,399 24	113,278 38
1876	5,939 30	390 00	5,549 30	118,827 68
1877	2,337 22	----------	2,337 22	121,164 90
1878	9,619 99	----------	9,619 99	130,784 89
1879	8,590 53	----------	8,590 53	139,375 42
1880	13,762 28	----------	13,762 28	153,137 70
1881	20,341 18	60 00	20,281 18	173,418 88
1882	51,449 27	----------	51,449 27	224,868 15
1883	34,482 28	825 90	33,656 38	258,524 53
1884	13,802 87	----------	13,802 87	272,327 40
1885	12,460 87	----------	12,460 87	284,788 27
1886	16,545 31	----------	16,545 31	301,333 58

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in War Bounty Bonds and held by the college.

TABLE NO. 3.—*Agricultural College Interest Fund.*

Year.	Interest on Agricultural College Fund, at 7 per cent, paid by State Treasurer from Specific Tax Fund.	Interest from purchases on balances due on certificates for part-paid land, less refundings and expenses for appraisals, etc.†	Receipts for penalty.	Trespass Collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to Treasurer of Agricultural College.	Balance remaining to credit of Agricultural College Interest Fund at close of each fiscal year.
1869	----------	$56 68	$2 28	----------	$58 96	----------	----------
1870	*$874 95	1,789 56	56 42	----------	2,720 93	$2,279 89	----------
1871	§ 1,397 97	2,317 24	70 63	----------	3,785 84	2,976 00	$809 84
1872	3,953 17	3,099 51	122 97	----------	7,175 65	6,774 47	1,211 02
1873	6,040 33	4,907 77	110 96	----------	11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12	----------	14,061 98	11,896 00	2,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,656 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,817 89	----------
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	----------
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	2,862 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 93	8,612 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96	----------	22,507 45	25,891 62	----------
1883	16,741 38	9,141 30	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 98	237 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,889 39	----------	----------	30,461 04	29,920 68	5,828 04

* This amount was interest on war bounty bonds in which the fund was invested at the time.

§ $525 of this was interest on war bounty bonds in which the fund was invested part of the year.

† Refundings amounted to $352.27, ranging from nothing in 1880 and since to $145.21 in 1874. Appraisal expenses amounted to $1,045.13, ranging from nothing in 1872 to $208.94 in 1886. Advertising amounted to $688.39, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883.

AGRICULTURAL COLLEGE LAND.

TABLE No. 4.—*Showing, by Counties, the amount of Agricultural College Land sold at original sale during the year ending September 30, 1886.*

Counties.	Acres.	Price.	Amount.	Amount Paid.	Amount Due.
Alcona	40.00	$5 00	$200 00	$200 00	
"	80.00	6 00	480 00	480 00	
Antrim	40.00	5 00	200 00	200 00	
Iosco	40.00	5 00	200 00	50 00	150 00
Kalkaska	80.00	8 00	640 00	640 00	
Montmorency	200.00	5 00	1,000 00	1,000 00	
Oscoda	120.00	5 00	600 00	600 00	
Wexford	40.00	5 00	200 00	50 00	150 00
"	40.00	7 00	280 00	70 00	210 00
"	40.00	10 00	400 00	400 00	
Total	720.00		$4,200 00	$3,690 00	$510 00

TABLE No. 5.—*Showing, by Counties, the amount of Forfeited Agricultural College Land sold during the year ending September 30, 1886.*

Counties.	Acres.	Price.	Amount.	Amount Paid.	Amount Due.
Antrim	40.00	$5 00	$200 00	$50 00	$150 00
Charlevoix	240.00	5 00	1,200 00	1,200 00	
Cheboygan	40.00	5 00	200 00	200 00	
"	40.00	6 00	240 00	240 00	
"	80.00	10 00	800 00	800 00	
Wexford	120.00	5 00	600 00	450 00	150 00
Total	560.00		$3,240 00	$2,940 00	$300 00

TABLE No. 6.—*Showing, by Counties, the amount of Agricultural College Land vacant September 30, 1886.*

Counties.	Acres.
Alcona	22,000.67
Alpena	960.00
Antrim	3,120.93
Benzie	4,400.00
Charlevoix	3,605.09
Cheboygan	5,211.10
Grand Traverse	440.00
Iosco	26,834.97
Kalkaska	1,000.68
Manistee	6,160.00
Missaukee	799.64
Montmorency	7,604.30
Oscoda	14,760.79
Otsego	3,704.74
Presque Isle	400.00
Wexford	23,240.00
Total	124,242.91

TABLE NO. 7.—*Income of the Agricultural College from all sources, from the date of its foundation to the present time.*

Year.	Appropriations for Current Expenses.	Appropriations for Special Purposes.	Land Sales, Salt Spring and Swamp Land Grants.	Interest from United States Land Grant.	Total.
1855			$56,320 00		$56,320 00
1856					
1857	$10,000 00				40,000 00
1858					
1859	37,500 00				37,500 00
1860					
1861	6,500 00		152 25		6,652 25
1862	10,000 00		218 97		10,218 97
1863	9,000 00		407 80		9,407 80
1864	9,000 00		726 09		9,726 09
1865	15,000 00		1,156 61		16,156 61
1866	15,000 00		1,094 27		16,094 27
1867	20,000 00		7,608 38		27,608 38
1868	20,000 00		592 49		20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96	67,617 96
1870	20,000 00		1,320 02	2,720 93	24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84	36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65	28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06	48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98	42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14	29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17	32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86	52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09	28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22	38,730 56
1880	4,971 80	7,068 32	797 55	17,837 24	30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25	72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45	39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60	63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72	48,080 62
1885		35,103 00	187 50	29,770 40	65,060 90
1886		22,617 00		29,920 68	52,537 68
Total	$362,083 60	$293,430 24	$99,561 72	$297,727 24	$1,052,802 80

TABLE NO. 8.—*Student Labor Account for Fiscal Year ending September 30, 1886.*

	Amounts Charged to Various Special Appropriations.	Amounts Charged to Special Appropriations for Student Labor.	Amounts Charged to Sundry Items of Current Expense.	Total Paid to Students for Labor.
Farm	$38 20	$897 03		$935 23
Garden	200 00	1,269 24		1,469 24
Greenhouse		292 03		292 03
Botanical Department	112 50			112 50
Zoological Department	15 00			15 00
Mechanical Department	67 00			67 00
Repairs of Buildings	312 37			312 37
Steam Repairs	66 16			66 16
Firing		90 98	$141 24	232 22
Janitor		431 56	511 35	942 91
Teaching, Choir, etc.			146 50	146 50
Bell Ringing			21 84	21 84
Totals	$811 23	$2,980 84	$919 93	$4,612 00

TABLE NO. 9.—*Statement of Special Appropriation Account for two Years, October 1, 1884, to October 1, 1886.*

Name of Appropriation.	Balance of Account October 1, 1884.		Receipts during two Years.			Total Available for Two Years on Account of Special Appropriations.	Total Expended during Two Years on Account of Special Appropriations.	Balance of Account October 1, 1886.	
	Dr.	Cr.	Remainder of Appropriations of 1883-4 Received Nov., 1884.	Appropriations of 1885-6 Received in Full.	Receipts of Institution on Account Special Appropriations.			Dr.	Cr.
Veterinary Department				$7,486 00		$7,486 00	$7,463 46		$22 54
Assembly Building				5,000 00	$1,131 99	6,131 99	6,376 43	$244 44	
Greenhouse				1,295 00		1,295 00	1,218 62		76 38
Farm Department	$549 27		$1,694 50	4,810 00		5,955 23	5,092 98		862 25
Horticultural Department	671 00		671 00	432 00		432 00	397 77		34 23
Chemical Department		$151 15		2,500 00		2,654 15	2,463 46		190 69
Botanical Department	234 34		1,115 50	800 00	15 00	1,696 16	1,307 21		388 95
Zoological Department		59 34		1,500 00	36 08	1,595 42	1,392 78		202 64
Repairs of Buildings		66 59		3,147 00		3,213 59	2,697 96		515 63
Mathematical Department	247 97		350 00	450 00	7 00	559 03	492 07		66 96
Mechanical Department		207 46		17,000 00	2 00	17,209 46	16,759 46		450 00
Library		1,197 51		3,300 00	158 55	4,656 06	3,910 81		745 25
Steam Works				1,400 00	54 26	1,454 26	1,307 41		146 85
Farmer's Institutes	189 59		300 00	600 00		710 41	635 19		75 22
Students' Labor				8,000 00		8,000 00	6,074 72		* 1,925 28
Experiments in Ensilage, etc.		488 64				488 64	293 00		195 64
Dwelling for Professor		539 57				539 57	539 57		
Boiler House		1,086 42				1,086 42	1,086 42		
Water-works		83 29				83 29	83 29		
Mechanical Tools	619 26		1,000 00			380 74	380 74		
Balances	1,371 54							5,554 07	
Footings	$3,882 97	$3,882 97	$5,131 00	$57,720 00	$1,404 88	$65,627 42	$60,073 35	$5,798 51	$5,798 51

* Of this amount $1,671.60 was paid out after October 1, during the fall term of 1886.

DEPARTMENT REPORTS.

REPORT OF PRESIDENT WILLITS.

The college year has been one of prosperity. As predicted in my report last year, the influx of new students for the spring term was as great as then anticipated, being 54, making an enrollment of new students for the year of 151, and a total in the college of 295. This year, so far, there have entered 95 new students, and with the matriculations impending next spring, our class this year promises to be as large as that of last year, and we shall have a total enrollment of 350 students, if we can get accommodations for them. The increase of numbers affects only the lower classes, as the senior class of last year was 33 and this year 24. When all the classes shall have felt the impulse of the increased attendance, if it shall continue, the college will number the 500 which is the number the plant justifies and demands. It will be recollected that these are all college students, in full four-year courses, without any side special courses, and without any preparatory department to swell the catalogue's numbers. But few colleges in the country, in the college department proper, exceed the numbers we now have.

It has been suggested that now is the time to raise the standard of admission. This suggestion comes from those who think the standard too low. But I am clearly of the opinion that there should be no change in the requisites for admission. The standard is practically the same as that at the Military Academy at West Point and the Naval Academy at Annapolis. The present requirements have the merit of taking the young men right from the well-appointed district school, with a habit for work well formed, and their taste for manual labor unimpaired. This is a very important consideration in an industrial institution like ours. Two years' additional study away from home before entering college tends to lead the young man away from the industries and into the so-called professions. This Agricultural College fills the place which no other institution does and which our people should foster; is a place at which the student may be made competent to enter any of the professions he may choose, but at the same time shall not be made to feel above any honest industry to which the exigencies of life may call him. This is the key to true success. We pride ourselves on the industrial *morale* of the institution, and we must do nothing to lower its tone.

While I adhere to the present standard for admission, it is incumbent upon me to say that many of the applicants that come to us, whether from district or graded schools, are not as strong as they should be in some of the primary studies—notably, in grammar. What there is so distasteful in the study of the principles of the language which is the basis of our daily speech, is one of the mysteries of our system of education. Still it is an undoubted fact that it is rare, either in teacher or scholar, to find any enthusiasm for the study. Hence it is desirable that all applicants should come specially prepared in that branch. This is peculiarly desirable in the Agricultural College where special stress is laid upon the acquisition of the faculty of using good English, and special training in the same obtains through the whole course.

THE NEW DEPARTMENTS.

This year's experience and work has demonstrated the wisdom of the Legislature in placing the Departments of Mechanic Arts, of Veterinary and of Military on an independent basis, with independent buildings and facilities for instruction. The new drill hall and armory has proved of great utility in the instruction in military tactics. There is but one institution of the kind in the country which has a superior. With the means to furnish it, the place can be made all that is desirable for commencement exercises. The new veterinary building has enabled the instructor in that important science to gather together all the apparatus needed for instruction, to have convenient dissecting and operating rooms in close proximity, and, in general, to give more thorough and exclusive attention to the subject than heretofore. The results have been eminently satisfactory.

THE NEW COURSE IN MECHANIC ARTS

Adopted two years ago, and for which the Legislature generously provided the means for a beginning, has prospered beyond our most sanguine expectations. A building containing lecture rooms and laboratories and shops was erected and and fully occupied last spring term. It was constructed for seventy-five students and has been filled to its utmost capacity in the one year and one term of the four-year course. This term the students have been obliged to work in sections of two hours each, from one o'clock to three, and from three to five, in order to get room to work. It is manifest that to accommodate the full attendance of four years' classes the shop capacity must at least be doubled. This will cost about $3,000. More room for draughting and laboratory work is very desirable, but not as imperative as shop room and a further supply of tools and machines and power, to provide for the students who will be added within the next two years, even at the rate they have applied in the last two. It is gratifying to note the earnestness with which professors, instructors and students have thrown themselves into the work and the very promising results that have been secured. We have rigidly adhered to our plan not to admit any student into that course who has no predilection for that industry, and the result is as we anticipated—there has been no impairing of the attendance in the Agricultural Course.

There is a strong demand from students in the Agricultural Course, and this demand is enforced by the almost unanimous wish of the parents, that facilities might be offered for a short term of practical instruction in the shop to students in that course. But it is manifest that such facilities can now be given to only a few. The spring term opens the last week in February. For six weeks, on account of the season, but little work can be done on the farm or grounds or in the garden. This time could be used for such a purpose. But still more room would be needed, which would cost $2,000, and an appropriation for the simple tools for that course of at least $500.

THE HORTICULTURAL DEPARTMENT.

The sciences are progressive, and in their advance tend more and more to a subdivision of work. When Agricultural Colleges were first established Botany, Forestry, Horticulture and Landscape Gardening were all included in one department. That was the case with our College. But as the years rolled along it was manifest that the field was too broad for one man, and wisely some years ago the Board divided the work and made of it two professorships. A building was erected and ample facilities furnished for Botany and Forestry. But nothing has been done for Horticulture and Landscape Gardening. There is no building and but few tools, and the expenditures have been sporadic, as the exigencies of other well-established departments might permit. The time has now come for a systematic development of this department, which has been too long neglected. In fact, while our College as a whole stands without a superior in the land, in this particular feature it is far behind many others. The importance of fruit culture is so great in this State, and the value of new and acclimated kinds and varieties is so far beyond computation, that the attention of the Legislature needs only to be called to it to meet with a liberal response. The horticulturists of the State are demanding with such vigor that this department should receive this recognition, that I beg leave to ask you to present a liberal estimate of its wants to the Legislature. At the date of this report the Professor in Horticulture has under him some 150 students (the freshman and junior classes) in manual labor, and with hardly half tools enough to supply them; with an office in a dingy hole in the basement of one of our buildings, in which basement is his only storeroom for tools, vegetables, and in which all the records for work and the distribution of gangs to their labor are kept and made. In fine, all the facilities of even a fair market gardener are wanting—to say nothing of lecture and apparatus rooms and facilities for experimental work which the importance of the subject demands.

STEAM POWER AND WATER WORKS.

The steam power is entirely inadequate for the heating of the buildings and for the power in the Mechanical Department. It was barely sufficient before the shops were added. It is imperative that two additional boilers be provided, also another engine for the shops. The water supply for domestic purposes has this year proven precarious. The long dry season has dried up several of the wells and rendered most of the others at times unsuitable for use. The large increase of students and the large number of visitors, sometimes running into the hundreds, have drawn so heavily upon the wells that it is a matter of dread to enter upon another year of possible drouth. The water for washing, etc., is now pumped from the river, but it has been so low this year as to make it of questionable quality for ablution purposes.

It is, therefore, desirable that an artesian well be sunk near the boiler-house and pumps, so that a permanent supply of pure water be obtained if possible, and that the tank be connected with the homes of the professors by suitable mains.

ACCOMMODATIONS FOR STUDENTS AND PROFESSORS.

I can but repeat or call attention to my last report relative to the pressing need for more dormitories or for a street railroad. The year's experience has demonstrated what I then said. Every room that can possibly hold a student has been fitted up and filled, and the next spring accessions will make it necessary to put three students in a room which is unhealthy, and unwise in many respects. The pressure for rooms by the professors, assistants and instructors increases with the increase of students. Several of them are now obliged to live in the city, which largely impairs their usefulness and is a severe tax upon them, especially in inclement weather. Opinion is divided between additional buildings and a street railroad. I incline to the additional buildings till the increase of students and visitors shall of itself bring the street railroad to us without any bonus. When that time shall arrive there will be practically no limit to the number of students, and the question of the attendance of ladies will then solve itself. A strong pressure comes from many quarters for accommodations for ladies. Now, while the College is open to them, there being no special building for them, it amounts to a practical prohibition. We have twelve lady students who find rooms with the professors, or come from their homes daily from the surrounding country. I believe that it is desirable that the number be increased. While the administration would be more severely taxed in one way, there would be ameliorating influences as a compensation in another direction by a larger attendance of ladies; and I have no hesitation in recommending that measures be taken to secure that larger attendance. But the College is now overflowing with young men and the more serious need is felt to furnish accommodations for them.

A CHARACTERISTIC DONATION.

A few years since a young man came to us from England and spent some two years at our College, but did not graduate. It was a source of constant amazement to him to find here such wonderful facilities for scientific study free of charge, and he always expressed a desire to show his appreciation of the benefits conferred in some way. I am in the receipt from him of a certificate of deposit, which with accumulated interest will amount to about $150. It will be used, with his approval, in the erection of a one-hundred-foot flag-staff in front of the Armory. At his request his name is withheld from the public.

THE EXPERIMENT STATION BILL.

At the request of the Board I spent six weeks in Washington last winter, seeking to promote the passage by Congress of the above-named bill. While there it was successfully passed through the Committee on Agriculture in the Senate and House of Representatives, but the exigencies of legislation allowed it to get no further than the Calendar. An effort will be made next winter to press it to a passage. Whatever the success may be in this Congress, the importance of the subject is growing in public esteem, and it is only a question of time when aid in some form will be granted.

In conclusion, gentlemen, I assure you that I am deeply grateful for your hearty co-operation and confidence. In this to me untried field of labor I have need of both. I appreciate the work; the grand possibilities of this institution are beginning to be more fully known, and I am more than ever convinced that success in all its far-reaching results is attainable.

EDWIN WILLITS.

AGRICULTURAL COLLEGE,
September 30, 1886.

REPORT OF THE PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF THE FARM.

To the President of the College:

DEAR SIR:—I herewith submit my report, of the work of the department of Practical Agriculture, for the college year ending Sept. 30, 1886.

141 students have received instruction in the department during the year, as follows: Freshman 92; Sophomores 49.

As in my last report I discussed the course in Practical Agriculture at length, indicating by the questions used at the examination of the respective classes the scope of instruction and the topics treated, it is only necessary for me to say in this connection that, with the increasing number of students, the work of instruction is made much more laborious and must soon necessitate the employment of a competent assistant.

The superintendence of a large farm, where improved breeds of animals are kept, necessitating constant attention to pedigrees and registration of same; the cataloguing and selling of stock; the looking after permanent improvements; the purchase of stores; the receiving, vouching for and accounting of a large business; the employment of help; the planning for student labor and its supervision; the carrying on of some experimental work; together with the teaching of large classes are among the duties that have demanded my attention.

While not entirely satisfactory either to myself or others, I may be pardoned for saying that I am content to leave the value of my labors, in all of these positions, to the verdict of unprejudiced and fair minded men.

I attended the Farmers' Institutes to which I was assigned at Grass Lake and Hudsonville and by invitation the local Institutes held at Eaton Rapids, Webster, Jackson and Okemos. I have also taken my turn in delivering the Wednesday afternoon lectures before students, and have prepared bulletins No. 13 on "Potato Culture—Varieties etc.," and No. 18 on "Wheat—Notes on different varieties and experiments with different amounts of seed."

MEETING OF TEACHERS OF AGRICULTURE.

At the June meeting the State Board of Agriculture appointed Hon. Henry Chamberlain and myself delegates, to attend the annual meeting of teachers of Agriculture, held at Purdue University, Ind., June 28, July 1.

The gathering was a very pleasant and profitable one. Profs. Latta and Throop, to whom we were indebted for much of the pleasure of our visit, are graduates of the Mich. Agricultural College, and were efficient helpers in various departments of work here after graduation. They now occupy the responsible positions of Profs. of Agriculture and Horticulture, respectively at Purdue.

We found them doing efficient work and their services seem to be highly appreciated by those in authority.

The Professors of Agriculture from the Agricultural Colleges and agricultural departments of the Universities of Kansas, Missousi, Illinois, Iowa, Minnesota, Ohio, Michigan and Indiana, with Prof. Lazenby of the Ohio Experimental Station and Hon Waldo Brown of Ohio and several other gentlemen were present.

The following topics were discussed and the interchange of views must prove mutually helpful to us in our work as teachers of Agriculture.

1. How can the teachers of Agriculture and Horticulture best excite the interest and enlist the sympathies of the farmers of their respective States?
2. What should be embraced in a course of practical Agriculture, and how can this course be arranged so as to meet the wants of those who desire to pursue it for a short time?
3. How much manual labor or practice should be required of Agricultural students?
4. What are among the most essential means of illustration in teaching Agriculture and Horticulture?
5. What are the chief hindrances to successful teaching?
6. What relatiou should the Agricultural College sustain to the National Department of Agriclture?

It was the unanimous expression of these teachers, from the leading Agricultural Colleges of this country, that the subject of Practical Agriculture was the most difficult to present, so as to interest and hold the attention of classes, in the whole range of college work.

If this is the verdict of those instructors who have but a small number of students in the Agricultural course (who are in College for the special purpose of studying Agriculture) and who are not burdened with any of the annoyances which a system of student labor entails; how is the fact intensified when, as is the case in our own College, we have classes varying during the year from 49 to 92, embracing not alone those who desire the study of Practical Agriculture, but many who do not and who have very little if any interest in the work.

Then the great difference so far as knowledge of agriculture is concerned among the members of my classes. To illustrate, in my last Freshman class I had a young man from Japan, who knew but little about cattle. Next to him was a young man whose father has for years bred good cattle and who has picked up a good deal of information concerning them. What the one can understand will not be very well adapted to the other. One needs milk and the other meat and the teacher of Agriculture is expected to give each his portion in due season. Again the students from the town and city have little knowledge of agriculture, while some of the young men from the farm think they know all about it and need no instruction.

In mathematics and the sciences, students of the same class begin together on an equality, one knows as much of the subject as another.

I note these facts as practical difficulties in the work of instruction, which are too often overlooked.

DONATIONS.

Donations have been received as follows:

Hand corn planter, from S. M. Macomber, Grand Isle, Vt.; hand seed Sower, from Goodell & Co., Antrim, N. H.; set of seed drill regulators, Seed drill Regulator Co., Lemont, Pa.; Devon bull calf, from H. W. Calkins, Allegan, Mich.

IMPLEMENTS PURCHASED.

The Vandiver corn planter with check rower, from Vandiver Corn Planter Co., Quincy, Ills.; a root cutter, from Belle City Manufacturing Company, Racine, Wis.; a milk cart, from Belle City Manufacturing Company, Racine, Wis.; a portable forge, anvil and small tools, from The Foos Mfg. Co., Springfield, Ohio.

IMPROVEMENTS.

We have continued the clearing of No. 16, and have extended our system of drains south of the Grand Trunk R. R., reclaiming several acres of low wet land. The drains in Nos. 12 and 13 are working admirably and on land, that was covered with water three years ago, the June grass and white clover have in many places made a strong turf. It has been a surprise to see how readily these grasses come in as soon as the water is removed.

While these fields are quite uneven, I am disposed to think it will be unwise to plow them. It would be years before we could secure such a sod as now covers them. Permanent pastures are coming to be appreciated more and more by stock men in this country and it is best to study the problem carefully before deciding to plow them.

BRIDGE OVER CEDAR RIVER.

A stone butment has been completed at the south end of the bridge crossing the Cedar river. At their last meeting the Board of Agriculture authorized the building of one at the north end. The old bridge is much dilapidated and is not safe. We are running great risks in using it longer. I recommend that estimates be made for an iron bridge of substantial plan and good finish, to replace the old wood structure as soon as possible.

The water tanks at the barns have been enclosed by neat substantial buildings, so planned as to exclude frost as far as possible.

Our water supply to which reference was made in my last report, has proved equal to the emergency of the past very dry season; furnishing an abundance at the barns and pasture fields, for all our stock.

EXPERIMENTS.

These have been in part reported in the bulletins to which allusion has been made.

The feeding test of calves of differemt breeds is under way.

We have two Galloways, one bred by Hon. R, B. Caruss, St. Johns, the other by Messrs. Townsend and Weeks, of Colby.

Two Holsteins, one bred by Seeley and Coleman, Lansing, the other by the College.

One Hereford, bred by Mr. E. Phelps, Pontiac.

Two Jerseys, one bred by L. G. Potter, Lansing, the other at the College.

Two Short Horns bred at the College.

One Devon, bred by Mr. H. W. Calkins, Allegan.

We have found it more difficult to secure calves of some of the breeds than we had expected. Those we have are doing well and the test promises to be an interesting one.

We intend to publish a bulletin during the winter, with breeding of calves, food consumed, and gains made.

SALES OF SEED WHEAT AND POTATOES.

Our sales of these products for seed have greatly increased during the year. I hope we may make the Farm department especially helpful in this way, by not only furnishing farmers with valuable animals of the improved breeds, but also with seeds and vegetables of reliable sorts and true to name.

APPARATUS FOR CLASS ROOM.

During the year, we have purchased a magic lantern and a hundred slides representing good specimens of the leading breeds of horses, cattle, sheep and swine. These will be helpful in making plain the characteristics of those breeds not kept athe College. Some charts illustrating the value of different cattle foods have also been added to our former supply. Also some sketches and photographs of celebrated animals.

STOCK.

In May last, Pres. Wells and myself attended the dispesion sale, of the herd of Short Horns owned by Mr. T. L. Harvey of Chicago, and purchased Mysie 44th a Cruikshank; Lady May, a Princess, and bull calf; Kirklevington Knightly 2, a Kirklevington.

SECOND ANNUAL STOCK SALE.

Our second annual sale was held on March 25. I append the following report of the sale made by Editor in Chief Gibbons of the *Michigan Farmer:*

"As announced, the second annual sale of stock took place at the Agricultural College on Thursday last. The day was fine, and the number of people present, among whom we noticed breeders from all parts of the State, gave evidence that the interest in improved stock was still as general as ever. Mr. J. A. Mann did the talking, and did it in an acceptable manner. The following is the record:

FEMALES.

Heifer, College Roan Duchess, by Col. Acomb 2d 37984, out of Roan Duchess of Crow Farm by 2d Airdrie of Ashwood 34334, to E. K. Wood, Stanton. Price, $215.

Heifer, College Red Rose 4th, by Col. Acomb 2d, out of Bonny Red Rose 2d by 23d Duke of Airdrie 19393, to E. K. Wood, Stanton. Price, $210.

Cow, College Phenix, by Gen. Custer 29618, out of Phenix 12th by Gloster of Ingham 17189, to James Edgar, Lakeview. Price, $125.

Heifer, College Alice, by Col. Acomb 2d, out of Alice Van Meter 2d by Aidrie of Ashwood 34334, to Wm. Steele, Ionia. Price, $235.

College Victoria Duchess 4th (dropped in January), by Col. Acomb 2d, out of Victoria Duchess 4th by Royal Belleville 12843, to J. M. Turner, Lansing. Price, $100.

Heifer, College Belle, by imp. Julius (48073,) out of Belle of Meadow Ridge 2d by Geneva Duke 2d 25630, to E. C. Mc Kee, Lansing. Price, $155.

BULLS.

College Waterloo, by Col. Acomb 2d 37984, out of Susie Bates by Airdrie of Ashwood 34334, to D. B. Hale, Eaton Rapids. Price, $95.

Hamlet 5th, by Col. Acomb 2d, out of Heroine by Rufus 18275, to Wm. Steele, Ionia. Price, $85.

Horace, by Col. Acomb 2d, out of Hermia 2d by Rufus 18275. Price, $85.

Horatio 4th 63046, by Col. Acomb 2d, out of Hela 3d by Rufus 18275, to H. R. Miller, Fowlerville. Price, $80.

Horatio 7th, by Col. Acomb 2d, out of Hela 5th by Gen. Custer 29618, to James M. Turner, Lansing. Price, $85.

Hebe's Acomb, by Col. Acomb 2d, out of Hebe 2d by Rufus 18275, to James M. Turner, Lansing. Price, $85.

College Airdrie, by 33d Duke of Aidrie 50833, out of Lady Catherine by 2d Baron of Morley (41047,) to D. B. Hale of Eaton Rapids. Price, $95.

Col, Page 2d, by Col. Acomb 2d, out of College Victoria Duchess 2d by 3d Grand Baron 39163, to J. H. Bosworth, Olivet. Price, $80.

Roan Acomb, by Col. Acomb 2d, out of Roan Duchess of Crow Farm 2d by Airdrie of Ashwood 34334, to Merritt Peckham, Devereaux, Jackson County. Price, $105.

Hamlet 7th, by Col. Acomb 2d, out of Heroine by Rufus 18275, to James M. Turner, Lansing. Price, $75.

The Jersey heifer Roscoe's Idyl 29508 A. J. C. C. Register, by Bobby Roscoe 10497, out of Idyl of Cedar Vale 2d 11896, went to J. M. Turner, of Lansing, for $95.

The Holstein heifer College Mae 2d, sired by Alexander 5th 1552 H. H. B., dam imp. Mae 102 D. F. H. B., went to G. L. Seeley for $100.

Two cross-bred Shorthorn and Galloway heifers were sold, one to R. B. Caruss of St. Johns, for $50; and the other to J. M. Turner, Lansing, for $30.

"The demand was strong for females, but it was hard selling the young bulls. There were some decided bargains, Mr. Hale, of Eaton Rapids, and Mr. Peckham, of Devereaux, securing the best. There was not a poor animal sold, and the visitors were unanimous in their commendations of the quality and condition of the stock offered. Fennell Duke 2d of Sideview, to whom the heifers sold were in calf, was highly commended."

STOCK SALES.

Sales of cattle during year amt. to	$4,336 93
Sales of sheep during year amt. to	302 82
Sales of swine during year amt. to	162 70
Total	$4,802 45

STOCK ON HAND OCT. 1, 1886.

Shorthorns	57
Herefords	10
Jerseys	3
Ayrshires	3
Holsteins	7
Galloway	1
Augus	1
Cross bred Galloway and Shorthorn	4
Native	5
Total	91

Sixty-three head of swine, embracing three breeds, Poland China, Essex and Berkshire.

One hundred and sixty sheep, American, Merino, Southdown and Shropshire.

CROPPING LIST.

The following cropping list for 1886 gives the area and yield of the crops grown upon the College Farm:

Field.	Area.	Crop.	Quantity.	Remarks.
No. 3	23.66 acres	Hay	16½ tons	10 acres devoted to experimental crops.
		Wheat	72 bushels	
		Potatoes	162 bushels	
		Mangels	400 bushels	
		Rutabagas	300 bushels	
		Sugar beets	200 bushels	
		Carrots	100 bushels	
		Oats	34 bushels	
No. 4	19 acres	Pasture		
No. 5	20½ acres	Oats, 15 acres	627 bushels	2½ acres too wet to crop.
		Hay, 3 acres	6½ tons	
No. 6	27½ acres	Clover	69 tons	
No. 7	17 A. 11 poles.	Pasture		
No. 8	23 A. 37 poles.	Wheat	600 bushels	
No. 9	23⅔ acres	Corn	18 acres, 600 bushels	
		Potatoes, 2 acres	219 bushels	
		Ensilage corn, 3⅔ acres	35 tons	
No. 10	22 acres	Hay	56 4-5 tons	Balance of No. 11 too wet to crop.
No. 11	23⅔ acres	Corn, 20 acres	700 bushels	
No. 12	23 acres	Pasture		
No. 13	23 acres	Pasture		
No. 14	10 acres	Oats	141 bushels	
No. 15	14 acres	Pasture		

FAIRS.

We have made exhibits at the State and Central Michigan Fairs, of Short Horn cattle. Also from our experimental fields of 18 varieties of potatoes, 16 varieties of wheat and ten of oats. Also mangel wurzel, sugar beets and carrots,

The arrangement and quality of the exhibit was commended very heartily by visitors. Sophomores Palmer and Seibert had charge of the grain and vegetable exhibit in part, and rendered valuable assistance.

I have departed from my usual custom this year and in a few instances have accepted invitations to attend fairs and act as a judge of cattle. I judged the following classes.

At the State Fair—The Galloway and Angus.
" " Central Mich.—The Short Horn and Hereford.
" " Eaton Co. all pure bred classes.
" " North Eastern—Short Horn herds.

It is very encouraging to one interested in good stock to note the great improvements made in the exhibits from year to year, and it is safe to say our Michigan breeders are among the first in their enterprise and skill.

STUDENT LABOR.

The increased attendance has compelled us to make two divisions of the students, assigned to work in the department, who have worked on alternate days or weeks. To make the labor of value either to the students or the department, only such numbers can be employed daily as can have careful supervision.

With increasing numbers, it may be well to think about making less of the work compulsory and more of it educational. To do this successfully will necessitate the purchase of more teams and implements and the employment of more skilled assistance.

I incline to the opinion that educational labor on the farm and garden can only succeed when it shall be placed on a par with laboratory work.

In conclusion it gives me great pleasure to express my obligations to those directly associated with me in the work of the department.

Mr. and Mrs. Ayres have cared for the farm house very satisfactorily.

Mr. William Brown still continues in the responsible position of herdsman.

Mr. H. T. French, class of 85, has filled the position of foreman of the farm with credit. The cordial coöperation of these and the other employés of the department I mention with sincere appreciation.

All of which is respectfully submitted.

SAM'L JOHNSON,
Prof. of Agriculture and Supt. of the Farm.

AGRICULTURAL COLLEGE,
October 20, 1886.

REPORT OF THE PROFESSOR OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President of the College:

The most important effort of the year just closed has been that devoted to student labor. With the increase of students and the development of means of instruction, the subject of student labor calls for more study. I adhere to the principle that the primary object of student labor is to instruct the student. So far as this is instructive alone I have not paid the student, but wherever it has been necessary and profitable to the department, whether instructive or not, the student has been paid. Upon the basis of remuneration, therefore, I divide student labor into two classes: educational labor, unpaid; illustrative labor, paid.

Educational Labor.—It has been the endeavor to make all strictly educational labor a part of class work, and make it necessary to the passing of the study of horticulture. This labor is not "putting in practice the class-room lectures," but is a supplement to those lectures. It is handling and experimenting with the plants and appliances which are discussed in the lectures. So far as possible this labor should precede the lecture. The student then becomes familiar with the object to be discussed, obtains a concrete notion about which he can group more recondite principles. Let me illustrate by the practice of budding. This fall all my students in horticulture, fifty-four in number, went through the operation of budding in the field before the subject was discussed in class. They were then prepared, without any preliminary class instruction, to understand why we bud, upon what physiological principles the practice depends, and to enter upon discussions of the influence of stock on bud and bud on stock. Without understanding the art, the practice, it is well nigh impossible to appreciate the science. Moreover, the art is first in importance and it should be first acquired, even if at the expence of the science. No one can acquire this art from a lecture. The student must perform the operation with his own hands. A man never learned how to build an engine from lectures alone. In general it is a waste of time and effort to lecture upon the art, the manual operations of horticulture, for when the student finally undertakes the operations the same and more particular instructions must be given. I lectured two days upon the practice of root grafting, whittling the stocks and scions and making particular mention of all the minor movements of the operator. The next day, however, when these students took the knives and materials into their own hands, I was obliged repeat all my former instructions. In other words I lost two lectures. Students could make much greater progress in my class work if they were familiar with garden operations when they enter the class. As it is, I am constantly beset and hindered by petty questions and ignorances which should be overcome before class-work begins. The remedy for this condition is to make work upon the farm obligatory to freshmen instead of to sophomores, and upon the garden and grounds to sophomores instead of to juniors. This change would also be a direct benefit to some of my colleagues. There are three other important advantages to be derived from such a system. First, students should be taught agriculture and horticulture before their thoughts are bent upon other subjects. At present the student receives no instruction in horticulture until he enters upon the second half of his course. By that time he is likely to have formed preferences for other subjects. Second, as the majority of our students leave college before the opening of their junior year, they receive no instruction whatever in horticultural matters. Most farmers' sons cannot afford to spend four years in college, but they have a right to demand some horticultural instruction from a half course at the college. The fact that most of our applied instruction occurs in the latter half of the course is no doubt an important reason why more farmers' sons do not attend the college. Other colleges have made provisions for those who cannot take the full courses. Third, the last two years would then be at the disposal of the student as far as labor is concerned, allowing him to pursue more particularly some special work.

Educational labor in my departmont should embrace a wide range of subjects. Some of these subjects are: management of hot-beds and forcing houses, potting and handling plants, making and repairing various tools, making mats for hot-beds, making cuttings, experimenting in cross-fertilization, budding, top-grafting, root-grafting, propagating plants, harvesting and marketing fruits and vegetables, storing fruits and vegetables, evaporating fruit, rearing seedlings under glass, testing seeds, experimenting with plant growth and variation, laying out walks and drives, sodding and seeding, care of ornamental plants, etc. This labor is all true laboratory work whether performed indoors or out. A great part of it must be performed indoors. Without facilities for carrying on such work, horticultural instruction can be little more than a travesty. Last fall we erected a very small forcing house at trifling expense, and this year we have enlarged it out of the odds and ends of materials. This enclosure affords room for carrying on work which it has been impossible to undertake before. It is entirely inadequate to our wants, however. The department is in great need of a full equipment. In the direction of work rooms, etc., it needs a building of considerable size containing two stories and basement, in which shall be an office, class-room, tool-room, general work-room, heeling-in cellar with root-grafting cellar attached, room for washing and packing vegetables for market and a storage cellar. In addition to this equipment, more supervision over student labor is necessary. Instruction cannot be given to more than four or six students at a time. With the number of students now enrolled in my class it is impossible for two men to give instruction during the year in even the larger part of the subjects named, even though the men had no other duties to perform. At present the afternoons of myself and foreman are entirely required in supervising the other and more general work in the gardens, orchards and upon the grounds. The more particular needs in this direction you have already in consideration.

Illustrative Labor.—Paid labor comprises all that which is necessary to be done for the good of the Department. In general it illustrates the best methods of performing horticultural labor. The hindrances to making this labor pleasant and profitable for all concerned lie chiefly in lack of tools, supervision and horse power. When the proper equipments are supplied I see no reason why our common work cannot be made very profitable to students.

Aside from attention paid to student labor, an experiment with tomatoes has consumed much time and thought. It has required the recording of no less than 5,000 distinct observations. The results of this experiment are given in Bulletin No. 19, which is just issued. It is proposed to extend this experiment next year, and to undertake three others in the same line of inquiry.

All the orchards and vineyards upon the College premises have been placed in a good state of cultivation. As fast as plants bear fruit the varieties are identified, and the plants labeled and platted. This labor of identification has been an arduous one this year. The inevitable confusion resulting from change in management cannot be easily remedied. The grape crop has been large and fine this year. From vineyard No. 2—that in the rear of the residence occupied by Professor Carpenter— a heavy yield was harvested. Owing to a lack of any place for handling these grapes they did not prove so profitable as they should. Although a heavy crop set in vineyard No. 1—that south of Wells's Hall—it was all appropriated before ripe. I recommend that in this vineyard a series of illustrative trellises be erected. A part of this vineyard was removed last spring to the Fruit Garden, to make room for an outhouse for Wells's Hall. The pear orchard is in excellent condition. So far no trees have been lost from blight. A fair crop for the age of the orchard was marketed this year. We also had an unusual crop of cherries. Most of the plum trees were killed or badly injuried by the winter of 1884–5. I propose to reset to hardier varieties next spring. A small orchard of native plums was set in the Fruit Garden last spring. We are now growing forty varieties. Specimens of most of the newer hardy fruits are now growing upon the premises. I hope to have means to keep up with this very important work of testing varieties. Although our climate is rigorous, I am nevertheless anxious to undertake some phases of peach culture, especially a line of experimenting with a view of breeding up hardier varieties. Soil suitable for this purpose does not occur within the limits of my department, however. We are now growing about two hundred varieties of strawberries. It is proposed next spring, to set nearly an acre comprising about five varieties, for market purposes. Our raspberry crop was very heavy, although pinched severely towards the last by the drouth. A market patch will be set this fall. A small orchard of crabs was set last spring. I desire to set a small orchard of representative Russian apples east of the main orchard next spring. No part of the college premises shows such improvement as the apple orchard. The crops this this year is fair, about two to three hundred bushels. Root-grafts of many new varieties of apples, crabs, pears, plums, cherrries and foreign fruits were set last spring. As these grow they will demand an extension of our grounds.

It is desirable to make a test of promising new ornamental trees and shrubs. We are paying very little attention to this matter. The most notable improvement upon the grounds is the construction of a summer drive along the river flats. Beyond the eastern extremity of this drive a half acre has been set aside for an experimental huckleberry plantation.

The results of various experiments and other notes of general interest have been contributed to the agricultural press at intervals during the year.

Respectfully submitted,
L. H. BAILEY, Jr.,
Professor of Horticulture and
Landscape Gardening.

Agricultural College,
September 30, 1886.

DONATIONS TO THE DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING FOR THE YEAR ENDING OCT. 1, 1886.

A. B. Cleveland & Co., Cape Vincent, N. York:
One pint Cleveland's improved Valentine Beans.
One pint Cleveland's Rural New-Yorker Peas.
One pint Cleveland's Alaska Pea.
Robert Douglas & Son, Waukegan, Illinois:
One doz. seedling Picea pungens.
One doz. seedling Pseudotsuga Douglasii.
E. P. Roe, Cornwall-on-Hudson, N. York:
Scions of Highland Beauty Apple.
J. Jenkins, Winona, Ohio:
Scions of Whinnery's Late Red Apple.
William Falconer, Glen Cove, N. York:
Seeds of Xanthoceras sorbifolia.
J. M. Thorburn & Co., New York:
Assorted Tomato seeds.

Prof. W. R. Lazenby, Columbus, Ohio:
Seeds of Papaw, Asimina triloba.
J. G. Justice, Marcus, Georgia:
Scions of Durham's Winter apple.
Everett Brown, Bluff Point, N. York:
Four Mary grape vines.
S. Gordon, Sand Brook, N. Jersey:
Over one hundred varieties of apple scions; also scions of crabs, pears, cherries and Chickasaw plums.
A. M. Purdy, Palmyra, N. York:
One doz. Big Bob Strawberry plants.
Francis Brill, Riverhead, N. York:
Assorted seeds of cauliflower and cabbages.
Thomas W. Bowman, Rochester, N. York:
Scions of Quebec Winter Sweet apple.
G. H. & J. H. Hale, So. Glastonbury, Connecticut:
Plants of Earhart Everbearing raspberry.
Babcock's Nurseries, Little Rock, Arkansas:
Scions of Arkansaw, Shannon and Kossuth apples.
Purdue University, by Prof. James Troop, Lafayette, Indiana:
Various small fruit plants.
D. F. Ewen, Pinckney, Michigau:
Roots of "Markery," *Chenopodium Bonus-Henricus.*
L. H. Bailey, South Haven, Michigan:
Scions of apple and pear.
F. L. Wright, Plainfield, Michigan:
Strawberry and dewberry plants.
J. T. Macomber, Grand Isle, Vermont:
New varieties of pears, plums, apples and a raspberry.
W. W. Hilborn, Arkona, Ontario:
New raspberries.
Thomas Love, Avery, Michigan:
Plants of Box, Buxus sempervirens.
Ellwanger & Barry, Rochester, New York:
Scions of Arabskoe apple.
Two Paradise stocks.
T. T. Lyon, South Haven, Michigan:
Small fruit plants in great variety.
J. D. Kruschke, Piqua, Ohio:
Plants of Twin and Big Bob strawberries.
Vosburgh and Shane, Grand Ledge, Michigan:
Plants of Moore's Early strawberry.
Kizo Tamari, Kagoshina, Japan:
Two large colored photographs illustrating Japanese gardening.
Hon. C. W. Garfield, Grand Rapids, Mich.
Various lithographs of horticultural products.

L. H. BAILEY, Jr.,
Superintendent.

REPORT OF CHEMICAL DEPARTMENT.

President Willits:—I herewith present my report of the chemical department for the College year just closed. The year has been full of busy cares and pleasant work in this department; the students attentive to their studies and enthusiastic in their work. The ample opportunities for original and independent work in the chemical laboratory have been appreciated and improved by the students in the higher classes. I am convinced that the best education is secured by encouraging the student to launch out for himself and to do his own work under the supervision of his teacher rather than by seeing any number of illustrations and any amount of demonstrations by another. It is in this sense that this large laboratory finds its proper use and justifies its name when it becomes the *working-place* of teachers and students.

The large additions recently made to the apparatus in the way of analytical and assay balances by Becker & Sons, of assay furnaces, gold and silver furnace of Orr & Hess, additional combustion furnace for organic analysis—these in addition to apparatus and appliances formerly on hand, have made the chemical laboratory the prized working place for earnest students. During the past year more than one hundred and fifty students have received instruction within its walls.

COMMERCIAL FERTILIZERS.

The last Legislature passed an act (No. 26) to provide for the inspection of commercial fertilizers offered for sale in this State, the retail price of which exceeds ten dollars a ton. The act provides that the analysis of such fertilizer shall be made under the direction of the State Board of Agriculture. The Board having appointed me to conduct such analysis, I gathered fifteen specimens of such fertilizers, analyzed them according to law and published the results in the form of a Bulletin.

SOURCES OF NITROGEN OF PLANTS.

The experimental work which I have been carrying on for four years in regard to the sources of nitrogen of plants, I have this year brought to a close. The results of this investigation were given in a paper read before the Society for the Promotion of Agricultural Science at its meeting in Buffalo, in August. The paper drew out an animated discussion and was received with favor. I also attended the meeting of the American Association for the Advancement of Science at the same place.

"THE PLAINS."

A number of communications have been addressed to the College officers asking information about the soil of the "plains" of the northern part of our peninsula, its nature, treatment and agricultural capabilities. I have given much attention to this subject in former years, examining the country and its productions along our western border, collecting and analyzing specimens of the soil, etc. At your suggestion I have made a similar tour of inspection in the central and eastern parts of this region, examining the land and its productions, gathering specimens of soil for analysis, and picking up what information I could from those who had cultivated these plains. I am now making an analysis of seven specimens of this soil. The native grasses of these plains have been submitted to Prof. Beal for examination and identification.

The people of these new counties recognize the fact that lumbering will soon be a thing of the past in that region, that some new industry must take its place if the region is not to be abandoned to primeval silence and savagery, and they look to the Agricultural College for aid in developing the agricultural capabilities of this large region, and the chemical department is endeavoring to do what it can in this direction. If more than a score of counties of such soil can be brought into successful cultivation and dotted with smiling homes, an inestimable good will be conferred upon our State. If, on the other hand, these soils are incapable of successful cultivation, this fact should be known and the failure and heart-break of unsuccessful pioneering be prevented.

METEOROLOGICAL OBSERVATIONS.

The tri-daily meteorological observations have been carried on during the year. These observations have been made continuously since April, 1863, and the results given to the public in the Reports of the Board.

FARMERS' INSTITUTES.

The six Farmers' Institutes under the patronage of the State Board of Agriculture were successfully conducted in different parts of the State last February. I attended and took part in the Institutes at Rochester and at East Saginaw.

LABORATORY REPAIRS.

The stone coping on the new part of the laboratory has been satisfactorily placed and the new tin roof on the north wing has been put on. The results in both cases have been satisfactory. The laboratory as a whole is in good repair.

I conclude my brief report by congratulating you on your successful administration for the year, and thanking you for the cordial support you have uniformly given this department.

R. C. KEDZIE,
Prof. of Chemistry.

AGRICULTURAL COLLEGE,
November 1st, 1886.

REPORT OF THE PROFESSOR OF ZOOLOGY AND ENTOMOLOGY.

AGRICULTURAL COLLEGE, MICHIGAN,
October 1, 1886.

To the President:

The past year in the Zoölogical Department has been exceptionally pleasant and profitable. The classes have been large, the students very punctual and industrious and the entire work of the department more satisfactory than ever before.

In the autumn term twenty-two of the twenty-six Seniors present at the College elected Zoölogy. Instruction was given wholly by lectures. The students made as satisfactory progress as could possibly be expected in the absence of all laboratory practice. During the last half of the term thirty-two students of the Junior class were under my instruction in Anatomy. The subject was presented by lectures. From one to two hours of laboratory practice each day were given to portions of the class.

The Junior Class to the number of thirty were under my instruction in Physiology during the spring term. The class was given laboratory practice in sections, each student spending two weeks—three hours daily—in this work. Thirteen students of the Senior class elected Geology the last half of the spring term. During the time of this study the class went with me to Grand Ledge, where the rocks were studied as seen at that fine outcrop.

The number of Juniors in Entomology in the summer term was twenty-eight. Besides the lecture room work, each student collected specimens for preservation, reared insects so as to study the transformations, and each student spent three hours a week in laboratory practice. This laboratory work was highly appreciated by the students, and is a most desirable addition to the course in Entomology.

Several students have done special work in the laboratory, which is always open for students. Mr. E. R. Lake, and Mr. Kizo Tamari, students engaged in post graduate study spent much time in special work in Entomology. Mr. G. W. Park came each day for one term for laboratory practice.

SUGGESTIONS.

I wish to renew the request that the Apiary be enlarged, and that a permanent assistant be secured to take it in charge. This would make the course much better, as it would give each student much more manual practice. This year five Seniors have made urgent request to work in the apiary. Some would prefer the work even at no remuneration. If the apiary were enlarged it would afford all needed opportunity for manual practice, and would also serve the better as a means of illustration. Again if we should do this we would secure many students who desire just such an opportunity. Many of these students now go to private apiaries, and so lose the scientific training which is a most important part of an apicultural education. Again, with the steady work which I now have in class room and laboratories, I have no time to care for the apiary, which is quite apt to devolve entirely upon me, under the present arrangements, just at the very busiest season of the year.

Our Apiary now consists of about forty colonies of bees and can be increased to the requisite number during the coming season. I recommend that the location be changed, and a special apiarian assistant be secured.

The laboratory work, while very desirable, makes more assistance necessary. During the past year Mr. C. P. Gillette has rendered very efficient service. We have commenced some important experiments which will be continued the coming year. We have arrived at important results already, an account of which follows this report. I hope Mr. Gillette's services will be secured for the entire year. With our present course this seems absolutely required.

COLLEGE WORK OTHER THAN INSTRUCTION.

During the year I have given one of the regular Wednesday Lectures, subject Louis Agassiz. I attended the St. Louis and Quincy Institutes, at each of which I gave two lectures. One upon Geology the other upon Economic Entomology. During the year I have prepared three Bulletins, all of which have appeared in the Report of the Board.

During the entire year I have taught a large and interesting class in the College Sabbath School. The subject of study was the Life of Christ.

EXPERIMENTS.

The usual number of inquiries have been sent to the Department. Often a single mail brings several such letters of inquiry. Such letters often require no little investigation which is always granted, and the desired replies given at the earliest possible moment. Thus the Department does the extra work of a State Entomologist. The present season we have carried on an extended series of experiments already mentioned.

THE APIARY.

We have made no experiments in the apiary the past season, except to try the "New Heddon Hive," and the solar wax extractor, with both of which we are well pleased. We have increased our bees from twelve to thirty-nine colonies and have sold quite an amount of honey. The season has proven that drouth alone does not surely prevent the secretion of nectar by the flowers. We have now so large an apiary that it is utterly impossible to manage it well with no other than student labor. Several colonies of bees have been sold during the year.

OUTSIDE WORK.

Early in the winter vacation I prpared a paper on the "Relation of pollen to the wintering problem," which I read before the North American Bee Keepers' Association at Detroit. I also prepared a monograph on "Insects Injurious to Forage Plants" for Dr. Beal's new book on Grasses. I also revised my Manual of the Apiary, the 14th, 1,000 of which was issued in May. During the year I have lectured before two large Farmers' Clubs, upon "Injurious Insects," once at Deerfield and once at Volinia.

DONATIONS TO ZOÖLOGICAL DEPARTMENT.

L. Reed, Orono, Mich:
Plant louse honey.
A. J. Root, Medina, Ohio:
Aphis sugar.
Geo. Mitchell:
Pinicola Enucleator.
J. Satterlee:
Strix Flaminea.
A. E. Gleason, Ceresco, Mich.,
Snake skin.

W. J. Beal:
Skeleton of swan.
Mr. Whitehead:
Odemia fusca (a pair).
C. A. Ward, Colorado:
Fluor spar.
White marble.
Copper glance.
White spar.
Silver ore (3 specimens).
Condensed lead fumes.
Iron pyrites with gold and silver.
Bismuth and silver.
Lead incompletely smelted.
Dendrite.
Anthracite coal.
Silver bearing galena.
G. A. Cannon:
Teeth of elk.
Bones of elk.
Pottery.
Chas. Helmore:
Emu's egg.
C. L. Ingersoll:
Golden eagle.
E. M. Preston:
Petrified or opalized wood. (70 specimens.)
Moss agate. (17 specimens.)
Volcanic lava, etc. (17 specimens.)
Sandwich island cloth.
Indian axe.
Tamarind.
Dried banana stem.
Sea lime.
Rock formation, Sandwich Islands.
Phonolite.
Sandal wood.
Coral.
Pod of plant.
Candle nuts.
Shells from Sandwich Islands (many).
Braids of human hair.
Seed vessels etc. of Accacia.
Sandwich Island grass.
Fragment of sacrificial altar.
Pod of Accacia.
Coral sand (3 specimens).
Petes hair.
Sulphurets of iron.
Silver ore (2 specimens).
Gold bearing quartz (23 specimens).

Sulphide of iron (3 specimens).
Barren quartz (2 specimens).
Surface quartz.
Quartz sneath and clay.
Granite showing drill mark.
Granite core.
Steatite (4 specimens).
Crystal of spar.
Quartz (3 specimens).
Quartz crystal (2 specimens).
Chloride of silver.
Tin ore.
Roasted ore (2 specimens).
Copper and iron sulphite.
Copper ore (3 specimens).
Cement copper.
Sulphide of silver (2 specimens).
Blue stone.
Kaolin.
Crushed quartz.
Sulphurets separated from quartz (2 specimens).
Roasted sulphurets.
Gold amalgam.
Pure gold.
Chloride of gold.

Mark Anthony:
Passover bread.

U. D. Ward:
Calamite.

A. J. Cook:
Maple sap lime.

H. L. Avery:
Liver & spleen of Lake Pike.

Robert Reynolds:
Deformed hen's egg.

Class '86:
Ball of clay.
Section of fossil tree.
Pyrites in shale.
Shale.

D. Kaufman:
Plant lice secretions.

W. E. Gammon:
Ruddy Duck.

D. A. Pelton:
Eggs of Song Sparrow.

G. C. Lawrence:
Egg with extra shell with excess of pigment.

J. W. Lowmey:
Oriole's nest.

Student:
Cast snake's skin.

EXPERIMENTS IN ZOOLOGICAL DEPARTMENT, 1886.

Much time was spent early in the season to determine the value of several insecticides; the effect upon plants as well as upon insects was closely watched. The results of these investigations are herewith presented.

KEROSENE EMULSION.

Previous experiments having showed that a milk emulsion is no better than a soap emulsion, and is often harmful to foliage, a soap emulsion was the only one used.

One lb. of Whale Oil soap was mixed with a gallon of water and all heated to the boiling point, when a half gallon of kerosene was added and thoroughly stirred while yet boiling. In several cases common soft soap was used, when the quantity of soap was doubled.

Applied to Radish Maggot (*Anthomyia raphani, Harr.*)

The emulsion was diluted with water till the kerosene formed one-tenth of the volume of the liquid used. The first application was made when the plants had been up one week and were one inch high. It was repeated once in three or four days for four weeks. The application was made upon each plant singly, a table spoonful being used each time. That we might be certain that each plant was treated the application was made with a glass tube with a rubber nipple attachment. For simply practical use the liquid could be turned on from a common watering pot, when more would be used. This would not injure the plants. At the expiration of the four weeks, twenty-four consecutive plants upon a treated row were pulled and carefully examined. Only six plants were injured at all by the maggots. An adjoining row containing thirty-two plants was also examined and twenty-two of these plants were injured.

The soil was loose sand, and the plants were not at all injured by the application.

Applied to the Cherry Slug (*Selandria cerasi, Peck.*)

The emulsion one to eighteen strong was applied to several infested trees. The slugs were annoyed but not killed. The following day most of them seemed as well as ever. Some of the small ones were killed. The foliage was not injured.

The application was made by use of Woodason's bellows atomizer.

Applied to Cabbage Caterpillar (*Pieris rapœ, Schrank.*)

No experiments were tried in the field. Upon larvæ feeding in the laboratory the emulsion was used one to twelve strong. In every case the insects were killed. They all died in less than three hours. Similar experiments with a liquid one to twenty strong, seemed to do no injury to the caterpillars.

Applied to Rose Slug (*Selandria rosœ, Harr.*)

The emulsion one to twelve strong was applied by use of a cyclone nozzle and Whitmore's fountain pump. The application was very successful in destroying the slugs and did no harm to the plants.

Applied to Woolly Louse on Alder (*Eriosoma tessellata, Fitch.*)

The strength used was one to twelve. The liquid was applied with Woodason bellows atomizer. It exterminated the lice and did no injury to the shrubs.

Applied to cherry tree Plant Lice (*Aphis cerasi, Fabr.*)

The emulsion was applied one to eighteen strong and one to twelve. In neither case were the lice greatly injured. In the latter case the foliage was somewhat blighted. A second application one to eighteen strong made twenty-four hours later destroyed all the lice. Similar experiments were tried upon the pig weed aphis with like results, except that the plants were injured more by the emulsion.

Kerosene on Squash Bug (*Geocoris tristis, Stal.*)

A little kerosene was turned into a vessel containing water. Into this the squash bugs were dropped in September when they clustered upon the squash leaves and were quickly gathered. All died in a few seconds.

CARBOLIC ACID EMULSION.

This was prepared the same as the kerosene emulsion. There is a serious objection to carbolic acid. If purchased in the crystalline form, it is expensive; if in the crude state, the strength varies so greatly that the mixture can not be regulated so as to make it safe, without repeated trials.

Applied to Cabbage Maggot (*Anthomyia brassecæ, Bouche.*)

The emulsion one to seventy-five strong was applied at intervals of from four to seven days for three weeks. At the close of the experiment, five only out of twenty-one treated plants were injured by the maggots. In an untreated row in the same bed sixteen out of twenty-four of the plants were attacked. The plants were uninjured by the emulsion. Mode of application and soil the same as in case of kerosene emulsion against the radish maggot.

Applied to Radish Maggot (*Anthomyia raphani, Harr.*)

A row of radishes was treated the same as with the kerosene emulsion every three days for four weeks. The strength was one to seventy-five, and each plant received about a tea-spoon full of the liquid at a time. Five only of eighteen consecutive plants were found infested at the end of the experiment. Twenty-two out of thirty-two plants in an untreated row were badly injured. All the plants were blistered and injured by the liquid.

Applied to cherry tree Plant Lice (*Aphis Cerasi, Fabr.*)

An emulsion one to 100 strong was applied the same as in case of the kerosene emulsion. The lice were all killed, and there was no injury to the foliage. The emulsion one to eighty strong was used on the pig weed apis. The lice were mostly destroyed, though the plants were considerably damaged by the liquid.

EFFECT OF CARBOLIC ACID EMULSION ON PLANTS.

A wool twine string was soaked in the emulsion before it was diluted, and buried an inch in depth close beside a row of radish plants. All the plants were killed. Applied to cabbage plants about the stems, as used to destroy the maggots; one to eighteen always killed the plants; one to twenty-seven killed half the plants and injured all; one to fifty-four killed no plants but weakened all; one to one hundred and eight did no perceptible harm.

Applied to young radish plants about the stems the carbolic acid emulsion one to thirty strong killed many and damaged all. The liquid was also applied to the foliage of the cherry, apple, apricot and currant with the following results: One to eighteen killed apple foliage entirely. The foliage of apple cherry, and red currant were respectively treated with the emulsion, one to 50, one to 75 and one to 100. The first blighted the leaves badly of all, but injured the currant most. The second damaged the currants cosiderably, but the apple and cherry but little. The third did no damage to the apple and cherry, and but little to the currant. Applied one to 100 on the leaves of the apricot it caused them to wilt some, but did no lasting harm.

A large patch of cabbages some distance from where cabbages had been previously grown, were treated extensively with the preceding insecticides, also with tobacco decoction, tobacco dust, California pyrethrum, Paris green and several other insecticides, using different strengths. As *none* of the cabbages in this patch were injured by maggots, the experiments were of no value, except to show that the application did not harm the plants.

TURPENTINE EMULSION.

This was prepared the same as the kerosene emulsion.

This liquid one to ten strong, was applied to the currant slug, (*Nematus Ventricosus, Klug*), cabbage caterpillar (*Pieris rapæ, Schrank*), and the cherry plant louse (*Aphis Cerasi, Fabr.*). The application destroyed the young of the first two species, but not the larvæ that were nearly matured. The cherry plant lice were nearly but not all destroyed. The application was very thorough. The same liquid was applied to the pig weed aphis. The lice were nearly all killed, and the plants much injured.

Effects of Turpentine Emulsion upon Foliage.

This emulsion is less damaging to foliage than even kerosene. One to ten upon cherry did no harm. One to five did no injury to apricot foliage.

PARIS GREEN.

This arsenical poison was always used in a mixture in water, and *was never* used upon any edible fruit, etc., except long prior to the use of the fruit.

Applied to Canker Worm (Anisopteryx vernata, Peck).

On the 24th of May many trees in a neighboring orchard, that were seriously infested by the canker worm, were sprayed with the above mixture, one ℔. of the poison to 80 gallons of water. The mixture was thrown upon the trees by a large force pump which was fastened to a barrel of the liquid mixture which was drawn in a wagon. Two days later hardly a live insect could be found upon the trees. The mixture was too strong, as the foliage was considerably blighted. Care should be exercised in applying this poison. The strength should never be greater than one ℔. to 100 gallons of water, and even then must not be applied too profusely.

Applied to Codling Moth (Carpocapsa pomonella, Linn.).

The effect of this application upon the codling moth larvæ was also noted. The application was rather late. It should always be made as soon as, or before the apples are as large as peas, else some of the larvæ will have passed into the fruit out of reach of the poison. One hundred apples from each of two Golden Russet trees were examined early in October. From the tree poisoned sixteen apples were not wormy; of the 100 from the tree not treated only two were sound. Sixty apples each from four Talman Sweet trees were examined. From the two trees poisoned fourteen and twenty-five apples respectively were found sound; from the two not poisoned six and nine. A Siberian Crab apple tree was treated May 31st. The apples were about the size of large peas. The application was very thorough. Many apples were examined in September and not one was wormy. Another Crab apple tree, not treated, not three rods distant, had hardly a sound apple. The same was true of several other trees close by. Two conclusions seem evident. For codling moth the Paris green mixture should be applied early, the mixture should be very dilute and the application very thorough. It is worthy of remark that four or five cents per tree is all that this costs, counting the labor, while its efficiency when rightly performed is wonderful.

Paris green was used for the cabbage maggot. Strength one ℔. to forty gallons. It neither injured the plants nor the insects.

CALIFORNIA PYRETHRUM OR BUHACH.

This powder, one year old, and not as strong as is fresh powder, was used with varying success. It was tried very thoroughly both as dust and in water for cherry plant lice, but to no effect. To the cherry slug it was very destructive as a powder, but did no good in water. Placed about radish plants every few hours it did no good in fighting the radish maggots.

TOBACCO AS AN INSECTICIDE.

This was used both as a decoction and as a powder, and it was very thoroughly applied. The plants on which the decoction was used were nearly all destroyed by the maggots. The same was true of those treated with the powder. The tobacco does no harm to plants.

Tobacco powder applied to Cabbage Flea Beetle (Phyllotreta striolata, Fab.).

This was applied when the dew was on the plants, and while it did no injury to the plants, it seemed very largely to drive off the beetles.

UNLEACHED ASHES.

These were used against the anthomyia with no success. Sprinkled upon the foliage it injured the plants seriously.

GAS LIME.

This was also used against the anthomyia. It killed the plants but did no harm to the insects. It was used as a powder and in water. The latter was not quite so injurious to the plants.

The above experiments were entirely in charge of Mr. C. P. Gillette, whose faithfulness and caution leaves little to be desired.

A. J. COOK.

REPORT OF THE PROFESSOR OF BOTANY AND FORESTRY.

To the President, Hon. Edwin Willits, M. A.:

The following table will show the number of students in the classes which have studied botany since my last report was made:

Term.	Studies.	Number in classes.
Autumn, 1885	Systematic Botany	52
	Advanced Students	2
Spring, 1886	Physiological Botany	44
	Advanced Students	2
Summer, 1886	Structural Botany	99
	Seniors Elective. Grasses	21
	Advanced Students	4
Autumn, 1886	Systematic Botany	79
	Mechanical Students, Study of Woods	22
	Advanced Students	3
	Total	328
	Counted in last year	54
	Net total on the roll	274

To teach these students has required, on the average, about five hours a day for most of the time, saying nothing about special preparations and other work.

Whether the work has been satisfactory or not, you and the State Board of Agriculture probably know. I have heard of no complaints, while the interest of the students was all that could be desired.

THE MUSEUM OF VEGETABLE PRODUCTS.

Considerable work has been done during the year in adding specimens, in writing labels and re-arranging things according to the natural orders to which they belong. Many visitors call at this museum, and compliments are numerous, very likely because such a museum is a rare thing, while most people have previously seen collections of fossils, skeletons, stuffed skins of animals, etc. Lack of money and want of time on my part have made it out of the question to place on exhibition everything which has been collected. Only a few specimens can be purchased. To get them, some one (and he is usually the curator) goes in person and brings them to the college.

THE HERBARIUM.

All the specimens, excepting a few collected during the last part of the season, have been placed in the cases with labels attached. The herbarium is now in good order. Many additions have been made to the list of seeds, dried fruits and specimens in alcohol for use in the class room.

THE BOTANIC GARDEN AND ARBORETUM.

These have been well cared for, and have been improved in some respects. The trees and shrubs are growing larger, and as they need it some have been removed. Former reports make it unnecessary to enter into details in this place. Both garden and arboretum will be the subjects for future bulletins.

EXHIBIT AT THE STATE FAIR.

In the spring term of the sophomore year the agricultural students spend two hours daily in the laboratory investigating plants, each aided by a compound microscope and other apparatus. For most of the time they all work on the same subjects, but each member of the class has a special topic to which he gives more attention. Each student makes small drawings and notes as he pursues his investigations. The drawings shown at the State Fair were the result of "special work," and with the exception of a portion of three plates were all original from nature.

These are not selections but are *all* the drawings on the *special* topics which were given to the students. Each student made other smaller drawings not there exhibited.

A glance at the drawings will reveal the name of the objects and the name of the student making them.

Below are the special topics, illustrated at the Fair, each by a card or two cards 23x31 inches: Structure of a leaf; the mouths of a leaf; the young hairs of a leaf; the sting of a nettle; protoplasm in motion; the palisade cells in a leaf; starch of the common potato and the wild Arizona compared; the frame work of a leaf; the crystals in the cells; the chlorophyll granules; why nuts are hard; tough and brittle white ash as seen magnified; the cells of oak; the cells of an apple; intercellular spaces; cystolithes or compound crystals; sections of buds; cotton, flax, hemp, silk and wool; pollen and its growth; the structure of a grain of wheat; the leaf of a Norway spruce; the hairs on pumpkin vines; experiments on protoplasm; sections of the leaves of grasses; root hairs; the tips of roots; the milk tubes in plants; the structure of a brown sea weed; a study of pond scums; diatoms; oscillatoria, water plants which crawl and wriggle; wheat-rust; corn-smut; the quince-rust; common bread mould; a cup fungus.

Here also were exhibited several kinds of compound microscopes such as the students use, retailed at $40 to $60 each. And here was a convenient box invented by the students and by Dr. Beal. The box is for holding the small accessories used by every student

The work above spoken of was not attempted in any American college twelve years ago. Students are taught to become independent workers.

WHAT OTHERS SAY.

In autumn of 1885 one of the editors of the *Botanical Gazette* spent two days at the Agricultural College, and in December there appeared what was termed "A Laboratory number."

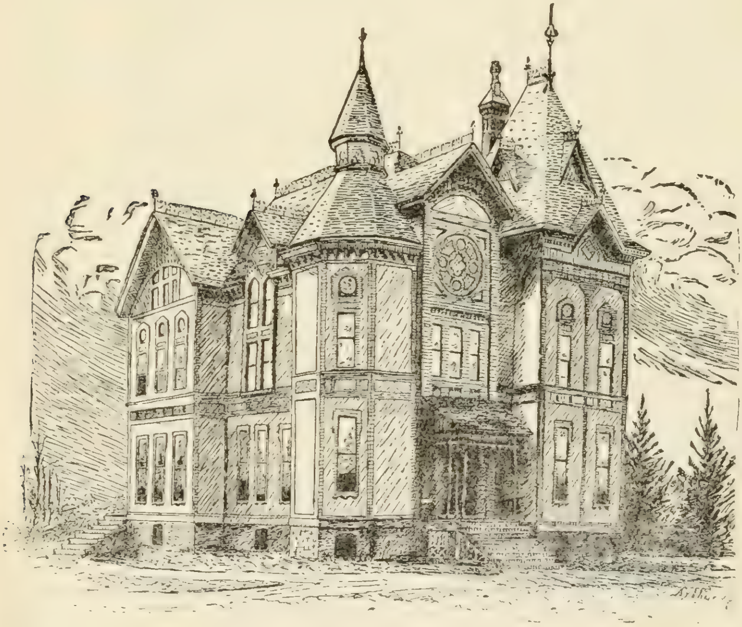
This magazine has been ably edited for ten years, and during the last few years edited and much enlarged by Dr. J. M. Coulter and Dr. C. R. Barnes of Indiana, and Dr. J. C. Arthur of the New York experimental station.

To these editors we are indebted for permission to procure a copy of a plate illustrating our botanical laboratory and museum.

I make the following brief quotations from the magazine for Dec., 1885:

"The first laboratory established was that at the botanic gardens of Harvard University, which was opened in 1872. The microscopes used are Zeiss (1 large stand, 3 No. VI), Verick (12), Leitz (3), Wales (1), Ross (1), with plenty of accessory apparatus. Taken as a whole the botanical laboratories of Harvard University are the most extensive and important in the country."

The magazine gives some account of the botanical laboratories of twelve prominent "institutions of learning," viz.: Harvard, Cornell, University of Pennsylvania, Illinois University, Michigan Agricultural College, the University of Michigan, Iowa Agricultural College, Wabash College, Purdue University, University of Wisconsin, University of Nebraska, Shaw School of Botany at St. Louis.



BOTANICAL LABORATORY.

"The botanical department of Michigan Agricultural College rejoices in the most imposing building especially erected for botanical instruction in the country. It is a modified Gothic, completed in 1880 at a cost of $6,000. The upper stories contain the botanical museum, very instructively arranged. [This is the only botanical museum referred to in the article quoted. W. J. B.]

"The laboratory on the first floor, also used as a lecture room, is 48x44 feet. It is lighted from east and west, and with ground glass windows on the south.

"The elementary course, with simple microscopes, permits most of the work to be done outside the laboratory. Codington lenses with convenient supports are chiefly used. The supply of compound microscopes is at present ample (27), and with funds for the purchase or others as needed.

"A conservatory and a fine botanic garden, including aquatic plants, a few steps away, and a virgin flora in the vicinity, furnish plenty of excellent material. The herbarium and library in the same building are fair size. This laboratory has long been noted for the observant and independent work of its students.

"Those only for Michigan Agricultural College and Cornell University have been designed exclusively for botany. * * *

"One way is to use a text-book or lectures, and then direct all laboratory work towards the so-called 'analysis' of plants. which means, of course, the comparison and naming of phanerogams. This may be called the oldest method, and is vastly better than nothing. Another plan is to have the laboratory work all directed towards the examination of parts called for in lectures, such as leaves, branches, roots, etc. This method is practiced in two ways, either as corroborating statements already given in lectures, or preliminary to such statements. The latter is much the better way, and has been well elaborated by Prof. Beal in his paper on 'The New Botany.'

"For work extending through a greater time, such as is obtained in well equipped botanical laboratories, the following courses, already in use in different institutions, are presented. No names are used, as the courses are only selected as types.

[Five types are given, one of which is that followed here.—W. J. B.]

"Beginners are started by having them examine a flower, a seed, a plantlet, a naked branch, anything, in fact, that is convenient or in season. Reports of the discoveries made are given before the class and discussed, the teacher directing all these results toward definite and correct conclusions No order of text is followed, but simply the order of convenience. The literature of the subjects examined is constantly consulted, though generally after the examination has been made. Soon some topic is assigned, which the student must 'work up' by observation and present in a final paper.

"For advanced students the work is of a similar nature, but closer observation is demanded and a stricter attention to details, and the study or comparison of structures is strongly urged.

"We venture to predict that at the end of the next decade, much more attention will be given to physiological botany. For this more appliances are needed than our laboratories now possess.

"We cannot too strongly emphasize the importance of having the botanical library in the laboratory, that the student may at least become acquainted with the names of writers and their books, and best of all with the literature of the subjects they are investigating.

"Several teachers desire to learn subjects which have been of use in the work of special students. [Several topics are named.—W. J. B.] In addition to these attention should be called to the subjects suggested by Prof. Beal in his 'New Botany,' already referred to."

Seeing the illustrated article above referred to, the editor of the *Michigan Moderator,* a State teachers' magazine, wished to use the cut and notice our botanical department. A fine article appeared. Then the editor of *Park's Floral Magazine,* of Pennsylvania, made a similar request, which was granted. The notice was a very flattering one, and very likely went a little beyond what the facts would warrant.

I make one quotation, because it expresses my ideal of the kind of work a teacher should aim at:

"The point in which Dr. Beal excels as an instructor is that of leading his students to observe and think for themselves He believes in studying nature, rather than books, and his efforts are always directed towards developing the mind of the student by inducing habits of careful observation."

The next, from the *Botanical Gazette*, is much like the above:

"Dr. Beal sets all his students to work, and the results of their observations form no mean contribution to botanical science."

Hon. C. W. Garfield, class of '70, Secretary of the State Horticultural Society, of the American Pomological Society, and editor of the *Michigan Horticulturist,* also requested the use of the cut of the laboratory, which he used in the July number of the *Horticulturist.* I take extracts from the magazine:

"At the June meeting of the Michigan State Horticultural Society, convened in Lansing, one of the most pleasant hours of the convention was occupied by members of Prof. Beal's class in botany. Seventeen young ladies and gentlemen, fresh from original work in the botanical laboratory, gave three-minute-talks to the assembled horticulturists upon topics which they had been studying by the aid of the microscope.

"The work these young people are doing at the Agricultural College was not attempted in any of our colleges twelve years ago. They are taught to be independent of what has been printed, and are placed at once in the field of original investigation. The glimpse they gave us of their methods spoke well for the work Prof. Beal is doing."

Here follows a list of the topics which is a selection from those named in the exhibit at the State Fair:

"The drawings made by the students and employed in their explanations were admirably executed, and on the whole the entire exercise was as interesting as anything ever presented to the Society.

"The students were questioned upon the topics they elaborated, by the horticulturists present, and the answers given were prompt and clear.

"The botanical department of our Agricultural College has a beautiful building in which these young people work, a cut of which forms our frontispiece.

"The work done here is rendered attractive to the students and is certainly calculated to stimulate original investigation in the field which the 'New Botany' occupies."

After returning home from the horticultural meeting, Secretary Garfield writes :

"As I recall the exercises of your students before our Society, I am filled with the idea that it would be well to have the whole thing go into our report, illustrations and all, if the matter can be prepared under your supervision. There is nothing like it in any report published. My thought is not to enlighten people so very much by the facts which these young people presented, but to popularize your method of work."

According to his request a report has been made to accompany the cuts and all will appear in the next report of the State Horticultural Society.

Seeing the account of the botanical department of our college in the Michigan Horticulturist, the editor of *The Home Farm*, of Augusta, Maine, urged that he might have the use of the electrotype. He made a very flattering article, some parts of which, in the opinion of the writer, were too highly colored. I quote a few of the milder comments :

"We can name no science more truly helpful to the farmer or gardener than botany. This knowledge comes into actual use in a study of grasses and forage plants, and their value: in relation to new fruits and vegetables, diseases of plants, and in many other ways. An acquaintance with this science makes them more competent, more observing, gives a greater pleasure to their work, and enables them to obtain greater profits from labor, for they work more understandingly."

I may add, that in *no case* above quoted did the writer hint or dictate what should be written. Neither did he know what the magazines were to contain till read in print.

Two other requests, six in all, have been made for the cut and some information for an article in the papers.

DONATIONS.

The donations have been as follows :

Dr. C. E. Bessey, class '69, Lincoln, Neb.:
Seeds of Helianthus annuus.

A. B. Cordley, Pinckney, Mich.:
Roots of tall oat-grass producing staminate flowers.

Dale A. Smith, Portland, Mich.:
Fragments of seeds, etc., from India.

Dr. E. L. Sturtevant, Director of New York Experiment Station, Geneva, New York:
160 varieties or races of beans.
W. E. West, Lansing, Mich.:
9 lots of wheat in the head from Bath, Mich.
Gleason Wood Ornament Co., Grand Rapids, Mich.:
19 blocks of wood pressed to imitate carving.
3 images made of pressed sawdust.
B. W. Steere, Adrian, Mich.:
One ear of red and yellow corn.
W. H. LeRoy, Rochester, Mich.:
Two ears of white corn.
J. O. Beal, Rollin, Mich.:
Limb of a plum tree with the black knot.
Department of Agriculture, Washington, D. C., Hon. N. J. Colman, Commissioner:
28 species of grass seeds collected on the prairies of the West.
J. C. Vaughan, Seedsman, 42 LaSalle St., Chicago, Illinois:
23 varieties of corn in the ear,
6 specimens Pampas plumes,
7 varieties of oats,
3 varieties of wheat,
1 variety of buckwheat,
3 varieties of barley,
1 variety of pea.
W. A. Taylor, Douglas, Mich.:
A very large section of sumach.
Kizo Tamari, Tokio, Japan:
3 Japanese persimmons.
M. Q. Anthony, Bay City, Mich.:
Two cakes of unleavened bread.
Chas. N. Eley, Smith's Point, Texas:
Three species of roots of grass.
Frank Kellogg, Muskegon, Mich.:
Fasciation in mullein.
One double grape.
P. G. Holden, Oviatt, Mich.:
One cob split with corn inside.
President E. Willits:
Old potatoes with young ones inside.

MISCELLANEOUS WORK.

I attended three or four farmers' institutes and declined to attend many others. During the summer vacation, I attended the Society for the Promotion of Agricultural Science, held in Buffalo, New York, and read a paper. In the same place, I read papers at meetings of the A. A. A. S. and the botanical club.

During the winter vacation I did considerable work in completing the first volume (now nearly printed) of my work on North American grasses.

Respectfully submitted,
W. J. BEAL,
Professor of Botany and Forestry.

AGRICULTURAL COLLEGE,
September 30, 1886.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND ENGINEERING.

REPORT OF SUPERINTENDENT OF SHOPS.

Mechanical Course.

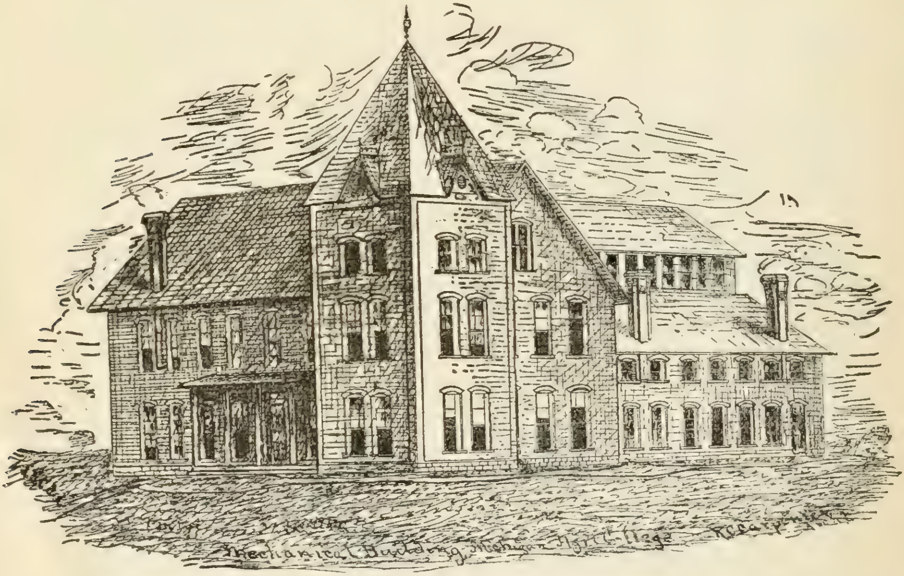
To President Willits:

Dear Sir—I have the honor to submit the following report of the shop and shop work for the year ending September 30, 1886.

Respectfully, R. C. CARPENTER,
Superintendent.

THE BUILDING.

The building was designed by myself. I also prepared with aid of students specifications and drawings. Mr. William P. Appleyard, the architect of the other buildings, erected in 1885, acted as superintendent of construction. The building was erected by Fuller & Wheeler, contractors, for $7,800. In the design of the building the utmost economy had to be exercised as respects ornament, in order to provide the shop with the necessary room and equipment and yet keep within the limits of the special appropriation for that purpose. The building as erected is plain and devoid of architectural ornament. It is, however, convenient, well constructed and satisfactory to all those who occupy it. The following is a cut of the building:


Mechanical Building Michigan Agr'l College
R. C. Carpenter

MECHANICAL LABORATORY AND SHOPS.

Front—First Story, 36x60 feet, Mechanical Lecture Room and Laboratory.
Front –Second Story, 36x60 feet, Draughting Room.
Rear Wing—First Story, 50x60 feet, Machine Shop.
Rear Wing—Second Story, 50x60 feet, Wood-working Shop.
Tower—First and Second Story, 16x16, Offices.
Tower—Third Story, Students Room, 16x16.
Attic—36x60 feet—Store Room.

APPROPRIATION AND EQUIPMENT.

The amount appropriated for the department was $17,000, of which $4,000 was expended for the house of Professor of Mechanics and $3,000 for his salary, leaving the amount available for the shop and its equipment at $10,000. Of this amount the building and furniture cost about $8,000, leaving for equipment about $2,000. This was expended approximately as follows:

Planer for iron	$500 00
Two lathes for iron	300 00
Belting and shafting	100 00
Forge and brass foundry	100 00
Castings for iron shop	200 00
Hand tools for wood and iron	500 00
Wood lathes and benches	100 00
Students' labor and material for fitting	200 00

The principal equipment of the shop is as follows:

Ten sets of tools for hand-work in wood, each set containing—

1 20-inch cross-cut saw,
1 24-inch rip saw,
1 12-inch back saw,
1 compass saw,
1 brace and set of 8 bits,
1 set of 6 firmer chisels,
1 smoothing plane,
1 jack plane,
1 block plane,
1 fur plane,
1 screw driver,
1 24-inch framing square,
1 8-inch try square,
1 bevel T square,
1 bevel marking gauge,
1 oil stone,
1 hammer,
1 mallet,
1 scratch awl,
1 brad awl,
1 oil can.

2 turning lathes for wood, 12-inch swing, wood beds, with two sets turning chisels and gouges.
1 10-inch swing engine lathe for iron.
1 12-inch swing speed lathe for iron.
1 planer for iron to plane 24 inches by 8 feet.
4 vises for bench work.
4 blacksmith vises.
5 blacksmith forges.
2 anvils and a limited supply of blscksmith hammers, hardies, flatters, etc.

By means of a previous appropriation the college had purchased

1 18-inch swing engine lathe,
1 6-inch swing engine lathe,
1 20-inch swing power drill,
1 8-inch shaper, and
1 12-horse power engine.

Our tools permitted work as follows: Wood shop, 12 students; iron shop, machine work, 6 students; iron shop, bench work and finishing, 7 students; blacksmith shop, 3 students; molding, 1 student; in the aggregate 29 students.

This equipment has lately been increased by the generous act of the State Board of Agriculture, providing tools for seven additional students in the wood shop. The Sturtevant Blower Company generously donated a blower, value about $100.

The work of the shop itself has been devoted largely to increasing its own equipments. Castings of two 15-inch turret lathes, designed by Mr. Meade, Superintendent of the Frontier Iron and Brass Works, Detroit, were purchased at a nominal price. One of these tools was finished in April, 1886. The other has been converted into an engine lathe, and is just completed. Castings for two lathes, 12 inch swing, were obtained of E. Dennis & Co., Jackson. These lathes are finished except cutting the gears.

Castings for one pattern-maker's lathe, designed by Mr. C. Taylor, of the University of Michigan, were obtained, and this lathe has been completed.

A gear cutter attachment, furnished with an index plate, made by Brown & Sharpe, has also been completed.

Patterns for a speed lathe, 12 inch swing, have been finished, and a set of castings taken from the same.

Steel tools, such as chisels, drills, lathe tools, have been made by the students in large quantity.

A set of three surface plates, 12x12 inches, and a surface table, have also been made. Work benches, drawing tables, tool cases, drawers, and various patterns have been made by students in the wood shop.

The result is that our equipment is materially better at the close of the year than at the beginning, and there is little doubt but that the shop work for the next year will be much more satisfactory than during the past year.

STUDENT WORK.

During the Fall term, 1885, the wood shop was not ready for the reception of students. Such work as could be undertaken in wood was done in the old brick carpenter shop, under the superintendence of Mr. H. B. Mohn. This shop was cold and poorly lighted, so that but little work was attempted. Work in the iron shop was done in a room in the boiler-house. It was equipped with power and answered its purpose very well. In the spring term work in both shops was interrupted very much by intervening matters incident to the establishment of the new course.

The shop work, because of interruptions mentioned, was not therefore fully organized before the opening of the summer term, 1886. During that term each student was required to work in the shop 2½ hours per day, and efficient and satisfactory work was accomplished throughout. During the whole year students worked in two divisions, each coming in the afternoon. This was necessary from the fact that there were more students than tools. From its economy, both of tools and supervision, this practice is likely to be continued. A limited number of students from the agricultural course were assigned work in the wood shop, and did creditably.

On the whole, the students did their work cheerfully and well and accomplished more in the first year than the most sanguine expected.

The use of the college tools for private work was allowed the students on Saturday forenoon. The result has been to encourage quite a number of them to undertake the construction of small steam engines. This work is believed to exert good influence and tends to arouse much interest and enthusiasm.

ORGANIZATION OF THE SHOP.

In the division of work, between the Professor of Mechanics and myself, the practical management of the shop was assigned to the engineering department. The work of instruction was divided among the employés of the engineering department, as follows: I acted as general superintendent, prepared the shop drawings and designs, and did all engineering work and business respecting the machinery and shop; Mr. James Wiseman, engineer at the college the past year, took the additional duties of foreman of the iron shop, with entire charge of the practical instruction of students in iron working; Mr. H. B. Mohn, who had been carpenter at the college since 1879, assumed the additional duties of foreman of the wood shop, with entire charge of the practical instruction of the students in wood working. Mr. Mohn resigned his position in August, 1886, and was succeeded by Mr. H. Campbell, of Detroit. It is hardly necessary to say in this place that this organization proved a success. The foremen did their duty well and gained the respect of all the students with whom they came in contact. Mr. Mohn resigned to join his family in California. We parted from him with much regret.

Mr. Wiseman still retains the duties of engineer and, with one assistant and student help, has immediate oversight of the heating works. Mr. Campbell, with student help, attends to repairs in wood needed in any of the college buildings. These duties have interfered, to a greater or less extent, with the shop work, and it would be desirable if it could be so arranged that the two foremen could give their whole time to their respective shops.

NEEDS OF THE SHOP.

Tools.—As the students increase in number more tools will be required. Even during the past year the efficient working of the shop was, to a great extent, prevented by lack of tools. Even if we continue to build lathes for the use of the shop we must have a few first-class tools of other makers. It is difficult to see how the machine shop can do efficient work unless it is provided with one milling machine, one automatic gear cutter, one shaper and one first-class screw cutting lathe. With the tools above mentioned the shop, in a few years, can solve the problem of its own equipment. In the wood shop several lathes are needed, a few of which can be built in the machine shop. The shop should be provided with at least ten more sets of carpenter's tools, five more sets of blacksmith's tools, a complete foundry outfit, several more vices, a buzz saw and a wood planer.

Engine.—The present engine will soon be entirely inadequate for the needs of the shop, and I respectfully recommend the purchase of a forty-horse power automatic engine.

Material.—A proper stock of lumber, of steel, cast iron, zinc and copper for brass making should be kept on hand in order that suitable work may be furnished the students.

Building.—The present shop is already worked to its full capacity and more room is urgently needed. The present shop should be given entirely to iron work as a machine shop. An addition 40x60 feet should be built on the south end of the present shop, one-half of which should be used for a blacksmith shop, the remainder for a foundry. A wing two stories in height, extending east or south from this addition and with dimensions of 30x60 feet, should be built for the wood shop. Proper store rooms and work rooms, which are urgently needed, could thus be provided.

Our present blacksmith shop is a mere shed, capable of accommodating only four or five students.

MICHIGAN AGRICULTURAL COLLEGE,
October 1, 1886.

To President Willits:

DEAR SIR:—I have the honor to submit the following report of the various repairs and interests not educational, in charge of the engineering department, for the year ending September 30, 1886.

Respectfully,
R. C. CARPENTER,
Professor.

REPAIRS OF BUILDINGS AND STEAM WORKS.

For these repairs we are organized as follows: I act as superintendent and engineer; Mr. James Wiseman, assisted by Richard Hiscock and sundry students, makes repairs in iron; Mr. H. Campbell, assisted by students, makes repairs in wood. At present repairs are done only by written request of the Secretary of the college, except such as pertain directly to the engineering department. In addition to repairs quite an amount of new work and improvements are done.

Although the repairs as a rule have been promptly done, it will no doubt give better satisfaction if they can be separated from the workshop of the mechanical course.

Some changes will have to be made in the steam works in order to secure more efficient heating, especially in Wells and Williams halls. With four boilers, each four feet in diameter and 12 feet long, we have been heating one and one quarter million cubic feet of space, situated at an average distance of about 450 feet, besides pumping each day about 8,000 gallons of water to an elevation equivalent to 90 feet in height, and 4,000 gallons to an elevation equivalent to 40 feet in height, besides furnishing steam for a 12-horse-power engine, run on the average seven hours per day. This has been accomplished only with the utmost difficulty and by an uneconomical use of coal. To furnish the necessary steam economically, we should have at least 50 per cent more boiler capacity.

The following tables exhibit the main points of our heating system:

Building.	Distance from boiler house in feet.	Elevation of basement floor above floor in boiler house.	Size of steam pipe, diameter in inches.	Size of return pipe, diameter in inches.	Cubic contents of building heated.	Remarks.
Williams Hall	454	9.75	4 except for 54 feet, which is 3.	3	359,472	Basement, 3 stories and Mansard.
Wells Hall	400	7.9	4, except for 100 feet, which is 3.	3	324,288	Basement and three stories.
Library	761	10.0	3	2½	250,272	Basement and 1½ stories.
Chemical Laboratory	675	4.75	2½	2	159,568	Basement and one story in part.
Mechanical Building	175	9.00	3½	2½	137,950	Two stories.
Boiler house	0	....	2	1¼	67,840	One story.
Total					1,299,390	

The following are not heated by steam:

Building.	Distance from boiler house in feet.	Cubic contents of building heated.	Remarks.
Veterinary Building	440 Via Mechanical Building	54,000	Two stories.
College Hall	784 Direct distance	230,000	Three stories and basement.
Botanical Laboratory	1,100 Direct distance	57,600	Two stories.
Military Building	1,100 Direct distance	89,680	One story.
Total		431,280	

The buildings not already heated by steam are used principally for recitation, and consequently in use but a few hours per day. Under such conditions steam heating can never be as economical as heating by stoves, unless the extra cost of insurance be reckoned an item of the heating. If we figure the cost of insurance as one-quarter per cent less for buildings heated by steam than by stoves, this would lessen the cost of steam heating by about $80.00 per annum.

CHIMNEY.

If the boiler capacity be increased 50 per cent, it will be necessary to increase the height of the chimney to the height originally intended, viz: to 90 feet. The foundation is ample for that height, the cornice only needs to be removed, and the chimney can readily be extended 25 feet.

I acted as purchasing agent for about two-thirds of the past year, but at my request I was relieved of such duties by the Board. I adopted the following classification to govern in the purchase of fuel and found it to work very satisfactorily.

The following classification of wood for fuel is to govern in all contracts made after the date of November 20, 1884:

Class A.—Split body wood of Hard Maple, sawed ends.

Class B.—Split body wood of Beech or White Oak, sawed ends.

Class C.—Split body wood of Tamarack, Black Oak, Elm, Soft Maple or Ash, or round, straight wood of Beech or Maple.

Class D.—Round wood belonging to Class C, sawed ends.

No wood accepted unless sound, neatly piled, when wanted, and from three to eight inches in diameter.

Crooked top wood not accepted.

WATER WORKS.

I was relieved, at my request, from charge of the fire department by President Willits at the beginning of the spring term. Up to that time I had regular fire drill once per week. This drill is now in charge of the military department and will, no doubt, be much more efficient.

As engineer of the water works, I call attention to the necessity of extending the works so as to give fire protection to the residence property on the grounds. The State has invested in residences and barns about $43,000 that is wholly unprotected from fire. During the extreme dry weather of the past summer most of the wells and cisterns in the west portion of the grounds were dry and the fire risk was exceedingly great. The cost of giving these buildings protection will be small, as the college has ample pumping facilities. What is needed is simply an extension of the main water pipe. For this purpose will be required 108 rods of 6-inch pipe, worth, in place, $13 per rod; 8 hydrants, worth $50 each; 40 rods of 4-inch pipe, worth $7 per rod—specials and value, $150.

The total cost would be $2,284, or about 5 per cent. of the value of the property protected.

There is also very much needed one additional hose cart, 300 feet of 2½ inch hose, 12 fire plugs in Williams, Wells and College Halls and the Library building, 500 feet of 2½ inch pipe, also 25 small hydrants for lawns.

The cost of these items, which are needed to put the fire department in efficient shape, would be less than $1,000.

MICHIGAN AGRICULTURAL COLLEGE,
October 1, 1886.

To President Willits:

DEAR SIR:—I have the honor to submit the following report of instruction given in the Department of Mathematics and Engineering for the year ending Sept. 30, 1886. Respectfully,

R. C. CARPENTER,
Professor.

RECITATIONS AND CLASS WORK.

During the Fall term of 1885 I taught classes in Agricultural Engineering and Drawing.

During the Spring term, 1886, I taught classes in Civil Engineering, Drawing and Surveying for the whole term, and in Geometry for a portion of the term.

During the Summer term I taught Drawing two hours per day.

Mathematics.—Professor Lewis McLouth taught Sophomore Algebra during Fall term 1885, and Trigonometry during Spring term 1886. Prof. L. G. Carpenter taught during Fall term 1885, Free-hand Drawing and Freshman Algebra. During Spring term 1886 he taught Free-hand Drawing and Geometry, and during Summer term, Geometry; having on the average for the year three and one-third recitations per day. For Fall term 1886, Prof. L. G. Carpenter has Algebra, two classes, Drawing, one class. Mr. J. B. Cotton has three classes in Freshman Algebra. I teach Agricultural Engineering and Mechanical Drawing.

For class instruction there are very much needed one additional surveyor's compass, several chains, two sets of pins, a pair of steam engine indicators and a small testing machine.

For the use of the drawing class there is needed a number of copies and models

Additional class room is very much needed for the classes in drawing and engineering.

An addition to the Mechanical Building 36x60, and two stories in height, adjoining the present building on the northeast, would afford the necessary room for the classes in mechanical physics in the first story and in the basement, and provide the necessary rooms for engineering and drawing in the second story.

Drawing Instructor.—There will soon be sufficient work in drawing to require the entire time of an instructor, and provision should be made for such help when needed.

We have to thank various manufacturers for donations of photographs and blue prints of their machinery, as follows:

Knowls' Steam Pump Co., three large framed photographs.
Worthington Steam Pump Co., two large framed photographs.
Russel Wheel and Foundry Co., photograph of light-house.
Buckeye Engine Co., framed lithograph and set of blue prints.
Betts Machine Co., set of blue prints of power drill.
Allis Machine Co., framed lithograph of Corliss engine.

REPORT OF THE DEPARTMENT OF MECHANICS AND ASTRONOMY.

Hon. Edwin Willits, President Mich. Agricultural College:

DEAR SIR,—I beg leave to present you the following report of the department of mechanics and astronomy for the last year:

During the first half of the fall term of 1885 I taught the junior class mechanics. As this department was quite deficient in illustrative apparatus, the Board made an appropriation of $150, which enabled me to purchase a number of needed pieces. During the whole of the fall term, too, I taught the sophomore class—in two sections—the subject of higher algebra. During the latter half of the fall term I taught the sophomore class and many volunteer students the subject of astronomy. The work was done by lectures and the topics covered were the form, size and motions of the earth and its position in the solar system. The methods of measuring and weighing the earth and of finding its distance from the sun were explained in an elementary way.

During the latter part of November and all of December I was busy preparing for the annual meeting of the State Teachers' Association, of which I was president. During January I prepared a paper on Our Indebtedness to Mechanics and Inventors, for the Farmers' Institutes. In January, also, I visited St. Louis, Michigan, and made the preliminary arrangements for the Farmers' Institute for Gratiot county. In February I attended and assisted at that institute and also at the institute held in East Saginaw.

During the winter I also, by direction of the Board, made quite an extended tour of inspection among the mechanical and industrial schools of the East.

I first attended the inaugural exercises of the opening of the Manual Training School of Toledo, Ohio. At these exercises ex-President Hayes presided and gave an address. Addresses were also given by Professor Felix Adler, of New York, Dr. Woodward of St. Louis, Mr. Harmon of Chicago, Mrs. Ewing of the department of Domestic Economy of the Iowa agricultural college, and others.

The school is attached to the public high school as a department and is controlled by the city school board, but the funds for the building and equipment were realized from the sale of a tract of land given a number of years ago by a wealthy citizen of Toledo. The shops are admirably equipped for instruction in wood work, metal work and in the domestic arts. The instruction constitutes a part of one of the regular high school courses of study.

I next made a short visit to Washington for the purpose of consulting with the commissioner of education and for the purpose of examining the collections of specimens, in his department, of the work of industrial schools, and also the collections of the Smithsonian Institute.

I then visited the United States Naval Academy, at Annapolis, for the special purpose of inspecting the work-shops of that school and learning something of their system of work.

The purpose of these shops is to train the cadets to mend or to replace any part of a ship. The iron working shop was especially well equipped with tools and machines. In this shop the pupils are taught every branch of the machinist's trade by a careful course of instruction in hand work and in machine work. The exercises are so arranged as to give the most varied skill to each pupil rather than with reference to turning out valuable articles. The skill attained, rather than the articles made, is regarded as the legitimate and most valuable out-put of the shops. I was shown, however, some very good small engines made by the cadets for propelling steam launches. The cadets are also taught the management of marine engines. For this purpose a marine engine is set up in the shops and a shaft and propeller wheel attached. By means of a brake whose resistance can be varied the intermittent working of the engines of a ship in a heavy sea is quite well imitated.

My next visit was to the Workingman's School, of New York, under the directorship of Professor Adler. This is a unique and very interesting institution for the manual, mental and moral training of poor children from the streets of New York. It is supported by private charity, and no children are admitted whose parents are able to pay for their instruction. Besides the ordinary branches of common school education, modified by the introduction of considerable objective work in the natural sciences, the arts of cooking, cutting and sewing, drawing, modeling in clay and plaster, wood carving, turning and some carpentry are taught. The object of this work is not so much skill as it is to reach and arouse the intellect through the eye, the ear and the hand. The distinguished director claims many cases of dull children whose sluggish minds have been touched and awakened into activity through the art lessons in drawing and modeling. As throwing light upon the question of the reflex influence of hand and eye training upon the mental powers, this school is of great interest to one seeking all possible guidance in the solution of the industrial school problem.

The New York Trades Schools were next visited. The ground, buildings and other outfit of this institution have been provided by private benefaction, but the cost of maintenance is met by the tuition fees of students. The school undertakes nothing but the teaching of the following trades: Plumbing, gas-fitting, brick-laying, plastering, stone cutting, fresco painting, wood carving and carpentry. The annual session is from the end of October to the first of April, and the hours for instruction are from 7 to 10 p. m. The tuition fee varies from $5 to $35 per session for each trade. From the specimens of work I saw in plumbing, wood carving, stone cutting and fresco painting, the instruction seemed to be very successful.

The method of teaching brick-laying was especially interesting:

A long room, well lighted from the sides and roof, and without floor, was the brick-laying "recitation room" or laboratory. Here, under competent foremen as instructors, and with "tenders," each evening, the pupils in brick-laying are at work building brick walls. Window and door frames are built around, corners, arches and pilasters are laid, and all parts of the brick-laying trade are taught, as well as the making and the proper tempering of the mortar. During the three hours' lesson these walls are carried up about as high as one can reach and the next day laborers take them down, clean the brick, retemper and mix over the mortar, so that the same materials are ready to be used again for the next lesson.

The rooms for the lessons in plastering are provided with alcoves whose sides and ceilings are lathed. Here the learners are practiced in wall and overhead plastering. The next day laborers remove the plaster, renew it and make it ready to be used again. Where two or three coats are applied, the first must be allowed to dry and harden, in which case the plaster can not be used a second time.

The students are mostly clerks and porters who are anxious to learn trades; and after they have learned their trades here, there is little difficulty in their getting profitable employment.

The Stevens Institute of Technology, at Hoboken, was next visited.

The chief object of this institution is the preparation of young men for the various branches of engineering. For this purpose a full and thorough course in drafting, mathematics, chemistry, metallurgy, physics, and the modern languages is offered, as well as a finely equipped shop, large enough to accommodate fifty pupils. The object of the shop work is not so much to secure individual skill with tools as it is to acquaint the pupil with proper methods of work, and with the properties and uses of materials. The shop exercises are so arranged that all pupils pass over exactly the same course, and in the same order. So much time is given to each kind of hand work, and so much to each machine. Under this plan, no attention is paid to the production of marketable articles.

The following table shows the number of hours devoted by each student to the various kinds of work:

Kinds of Work.	Hours.
Carpentry, pattern-making and wood turning	165
Metal planing and milling	87
Drill press work	24
Vice work	40
Molding	40
Blacksmithing	40
Steam fitting	16
Total	312

The remainder of the shop work, about 80 hours, is rather of the nature of scientific laboratory experimentation.

The tuition fee in this institution is $150 per annum for residents of New Jersey, and $225 per annum each for all others.

The next visit was made to the Worcester Free Institute, located at Worcester, Massachusetts. This was founded in 1865 by private benefaction, and is one of the oldest industrial schools in the country.

Its course of study is three years, but as the requirements for admission are a full year higher than our own, graduation from the Worcester Institute implies about the same grade of discipline and of scholarship as from our course in Mechanic Arts.

The workshops connected with this institution, endowed by Ichabod Washburn in 1866, and having since received other bequests, are among the best equipped in the country.

The floor area of the shops is about 23,000 square feet, and the building contains an engine and boiler room, blacksmith's shop, tool room, draughting room, painting and finishing room, wood-working and metal-working rooms, and other auxiliary rooms. Drawing is taught during the entire three years' course. The wood-working consists of bench work with carpenters' and cabinet-makers' tools, wood-turning, machine sawing and planing. The course in metals covers bench work to a limited extent, work with the speed and with the engine lathe, drilling, milling, planing, screw-cutting, forging, tempering, tool-making, management of steam, as well as designing and constructing. The course seems to lay far greater stress upon metal-work than upon wood-work, and on machine than on hand-work.

A distinguishing feature of this institution is the effort to carry on the work in the shops as nearly as possible as work in real shops is carried on. For this purpose the students are so divided into sections that each works two full half days of five hours each week. One section, for instance, will work from one o'clock to six Monday afternoon, and from seven o'clock Tuesday forenoon till twelve. Another section works Tuesday afternoon and Wednesday morning, and so on during the week. The academic work of the institution is made to conform itself to this arrangement.

To the same end—the making of the shop practice as nearly like shop work as possible—there are given few or no *exercises* as such, every student being required to put all his work upon articles which, when completed, shall be salable in the markets. To this end, too, the shop management has a special line of articles to be manufactured for the trade, besides competing with other shops for general work. In order to do this it is necessary to supplement the student labor with the labor of a dozen or more regularly employed mechanics. In 1884 there were sixteen mechanics thus employed, while there were that year one hundred students at work. During that year there were manufactured and sold goods to the amount of $19,500.

Another peculiarity of the shop work is that comparatively little attention is given to *hand* work, *machine* work being employed by preference as much as possible.

The charge for tuition is $150 per annum, except for residents of Worcester county, who receive gratuitous tuition.

The Massachusetts Institute of Technology, located in Boston, was next visited. This institution receives one-third of the income of the Agricultural College land grant of 1862 for the State of Massachusetts. The work of the Institute is divided between two leading schools, the *School of Industrial Science* and the *School of Mechanic Arts.*

The conditions of admission to the School of Industrial Science are high, the courses of study are full and strong four-year courses, and are intended to fit for civil, topographical, mechanical, mining, and electrical engineering. The school of mechanic arts has a more elementary two-years' course of study, including daily shop practice for the entire time. The shops are extensive and richly equipped. The wood shop is provided with 40 carpenter's benches and sets of tools, two circular saws, a swing saw, two jig saws, a buzz planer, a boring machine, 36 wood lathes, a large pattern-maker's lathe, and 36 pattern-maker's benches and sets of tools. The foundry has a cupola furnace for iron, two brass furnaces, and 32 molder's benches. The blacksmiths' shop has 32 forges, seven vises and the requisite outfit of hand tools. The machine shop contains 22 engine lathes, 15 hand lathes, a machine drill, 2 planers, one shaper, one universal milling machine, one grinding lathe, and 32 benches with vises and hand tools for bench work.

The work in the shop progresses by a regular and systematic course of graded exercises devised with reference to the best and fullest instruction of the student, and with no reference to the market value of products.

The tuition fee for the course in mechanic arts is $150 per year; for the course in industrial science it is $200 per year.

A reference to the published lists of the present employment of graduates of the Massachusetts Institute of Technology, the Worcester Free Institute and the Stevens Institute of Technology shows that a very large proportion of them are filling responsible and lucrative positions as engineers, draughtsmen, superintendents, and foremen in manufacturing and engineering establishments, or as teachers in technical and scientific schools.

In briefly summing up the results of my observations and inquiries, I would say that on the question of the manner of conducting the work of the shops in the industrial and technical schools, there are two sharply defined and quite antagonistic opinions among those connected with or interested in these schools; and in the discussion of these opinions—sometimes a little heated—two parties have sprung up. The one party, headed by Worcester, and closely followed by the Rose Polytechnic School of Terra Haute, Indiana, insists that the school shops should be conducted like real business shops, and that the product must be marketable. This party believes that few or no exercises should be given merely for the sake of practice, but that every article made from the beginning of the student's work, must have a marketable value. These men insist that the student will work better if the article upon which he works is to have, when finished, a use and value over and above its value as a practical exercise.

The other party, led, perhaps, by the Massachusetts Institute and followed by the United States Naval Academy, the Manual Training School of St. Louis, the Stevens Institute at Hoboken, and most of the other schools, noticeably those connected with the colleges, insists that *instruction* rather than *construction* must furnish the key note of the work. These men claim that in the effort to compete with real shops in the production of merchantable articles, pupils are inevitably kept so long at single kinds of work in order to become skillful, that the range of the student's practice is narrowed and his instruction is made to suffer for the sake of profit to the shop. They claim that it is as impossible, without detriment to the pupil's instruction, to make the product of students' work in the shop salable, as it would be to make the instruction of a class in grammar or rhetoric self-supporting by selling the pupils' compositions and exercises to the magazines and newspapers.

The argument for making these school shops entirely or partially self-supporting by the manufacture of salable articles, has certainly a pleasant sound to the popular ear; and yet I believe that, like many other popular arguments, there is in it a fallacy. There is a law of compensation holding everywhere that holds here. We must *learn* before we can *earn*. The student cannot earn fees during his first readings of Blackstone, cannot practice medicine while taking his first lessons in anatomy and pathology.

I believe it to be impossible by the mercantile method, and with the purpose strong to make the shop to any great extent self-supporting, to arrange the exercises so as to give to all pupils so even and uniform and general and well graded a course of instruction as by the other method. A shop superintendent who is required to show as large an income as possible from the sales of the products of his shop, and whose success is measured by this standard, will almost unavoidably be tempted to keep pupils at those kinds of work which pay best regardless of their progress. This is, indeed, the very objection brought against the present system of apprenticeship, under which the apprentice is kept at work at whatever he happens first to learn to do well, and by which not finished workmen but very narrow specialists are turned out.

These opinions are the more confidently expressed because they are the opinions of the greater number, as, I believe, of the best industrial and technical school men of the country. Dr. C. M. Woodward, Director of the St. Louis Manual Training School, one of the oldest and ablest advocates of industrial education in this country, is very strongly of the opinion that every attempt to make merchantable articles in the school shop will result in injury to the instruction. The authorities at the Naval Academy, at the Massachusetts Institute and at the Stevens Institute were found to be equally strong in this opinion. It is possible that these two parties, driven apart in the spirited discussion, have drifted each into extremes, and that a golden mean lies somewhere between them.

In our own case, I think it wise to feel our way carefully, not undertaking to construct articles for sale in the markets, but only so far as can be safely done for the further furnishing of our own shops. Even in attempting this, the observation of the past year teaches me that there is great danger that in our anxiety to finish a tool or a machine, all our pupils will not be given equally wide ranges of practice, or that some will be kept unduly long on work simply because they can do it well; and this danger is likely to increase as our numbers increase beyond the reach of the foreman's personal oversight and attention. Grading and classification are just as important helps in shop instruction as in any other, and these cannot be had when each different student is engaged upon a different kind of work.

Then, too, in a State school, especially, we should avoid anything that looks like competition with our private industries. Still, it is possible that with larger experience, and with time to systematize our work more completely, we may find branches of industry, not practiced in Michigan, which we can profitably engage in to a limited extent, without detriment to the instructional value o our shop practice, and by means of which the cost of raw material consumed may be, in part, covered.

I noticed in some of the shops I visited twenty or thirty lathes of the same size and pattern. I believe it is much better, as giving a wider range of experience, to have as great a variety of pattern as possible represented in the tools and machines of the shop. In this respect I think we have started right. Neither would I recommend the purchase of large machines, nor the undertaking of heavy work. Our pupils are young, and lack the physical strength necessary to handle heavy pieces: besides, all operations can be taught on small articles as well as on large ones. Every possible precaution, too, must be taken against the possibility of maiming or injury to students in the shops; especially is there need of this in the use of wood cutting machinery.

On the whole, the results of my trip of observation gave me encouragement to believe that we have made a good beginning. The equipment of our shops is certainly not contemptible, and the work of our pupils in this, the first year, need not be ashamed to be compared with any I saw in the older institutions. During my trip I took the opportunity of visiting the observatories and laboratories of Harvard, Yale, and Johns Hopkins.

During the spring term I taught the freshmen mechanical students elementary physics, dividing the class during the latter half of the term into four sections, and giving them a course of experimentation at the tables in my laboratory. They also assisted in devising and making several pieces of apparatus,—one, for instance, for determining the coefficient of gravity, and one for illustrating the laws of falling bodies.

During this term I also taught two sections of the sophomore class the subject of trigonometry. During the summer term I taught the sophomore class mechanics and the senior class astronomy. During this term also, by vote of the faculty, I prepared the annual catalogue and attended to its printing. During the year Professor Carpenter and I prepared the full four year course of study for the department of mechanic arts.

RECOMMENDATIONS.

I join my voice with Professor Carpenter's in recommending that the Board ask of the Legislature an appropriation for the addition to our shops which he urges in his report. Without some relief of this kind at the beginning of the next year, when our third class enters, we shall be greatly embarrassed to find room for all our students, and when the fourth class enters in the fall of 1888 we shall be totally unable to provide for them.

I would also emphasize and urge his recommendation that the main part of the mechanical building be enlarged by a two story addition at the northeast corner. This addition is greatly needed,—the basement and first floor for a mechanical lecture room and apparatus rooms, the second floor for lecture room for the professor of engineering and a tower furnished for a computing room and observatory for astronomical purposes. The present little observatory is inaccessible in position, too small and unfit often by reason of dampness for the preservation of our telescope.

If this addition is built my present lecture room and laboratory would be converted into a much needed laboratory for experiments in mechanics.

I also beg leave to recommend in the interest of the new department of mechanic arts the appointment of a teacher of drawing for next year and thereafter. The classes in drawing are becoming so numerous as very soon to require the entire time of one instructor. I would also urge that the services of a shop superintendent be secured for the year beginning in the fall of 1888 and thereafter. It is possible that a detail might be secured from the U. S. government of a suitable graduate from the naval academy for this service. So many new classes are created by the new course that Professor Carpenter and his assistants cannot possibly attend to these duties in addition to his own proper work in mathematics and engineering.

I also ask that provision be made for an assistant in my own department for next year and thereafter. Competent young men can be found willing to serve as assistants at from $300 to $500 per year. I shall be obliged to provide for the instruction of from three to five classes a day after the beginning of next spring term ; and if the work is to be done by the laboratory method, as most certainly it must be, these classes will need to be divided into a number of sections of suitable size for supervision.

I ask for an appropriation of $500 for each of the next two years for mechanical apparatus and material. My department being a new one is almost without apparatus for illustration. An additional $500 ought also to be provided for securing a small astronomical transit. Except for mere star gazing we are without astronomical apparatus. A time keeper and a transit are necessary for all kinds of practical astronomical work such as every civil engineer ought to be familiar with.

For the purpose of supplying heat and light for experimentation in the mechanical laboratory, I would urge the purchase of a gas machine, not to cost over $250.

Of course, as French and German have been offered in the mechanical course for next year, it will be necessary to make provision for an instructor for those languages.

I also beg leave to add the following suggestions concerning matters, which, though outside of my own special department, are still closely connected with the recent enlargement of the college in the direction of mechanical and kindred industries.

We have now a dozen or more young women in our classes, and the number will naturally increase as fast as opportunities are offered, and yet, no provision is made for their industrial training in any direction. I know of no reason why industrial schools should not offer to young women, as well as to young men, courses that are intended to fit them for their own proper industrial pursuits. We are not offering anything in the nature of handicraft instruction suitable to their sex.

Permit me, then, to suggest to you, and through you to the Board, that, as soon as may be, and this could be easily provided for if the proposed addition to the mechanical building is secured, a suitable room be fitted up for a womans' industrial laboratory, where, for a couple of hours each day, while the young men are engaged in the fields or shops, the young women may practice and learn such light handicrafts as are suitable. I may name among these photography, type writing, telegraphy, typography, wood carving, scroll sawing, etc. A couple of hours devoted each day during the course to these things, besides being beneficial to health, would enable them to learn lucrative callings, should they choose to follow them. The cost of an outfit for such a laboratory would be quite trifling in amount.

Again, as I hear that a building for a young woman's dormitory may possibly be asked for, I would suggest that a model kitchen and dining-room be fitted up in this proposed building, and that they be put under the direction of a competent lady as matron and instructor in domestic economy and household art. I believe by doing this we can greatly enlarge the usefulness of the college by making it as helpful to the young women of the State as to the young men. There is no argument needed, I know, Mr. President, to convince you or the Board of Agriculture that women educated and trained in their duties contribute as much to the prosperity and happiness of a State as do educated men.

Trusting that it will not be deemed impertinent in me to offer these suggestions, which certainly pertain to manual and industrial training, and thanking you for your courtesies and coöperation during the past year, as we have been engaged in starting the new department of Mechanic Arts, I beg to present to you this, my annual report.

Respectfully,

LEWIS McLOUTH,
Prof. Mechanics and Astronomy.

REPORT OF THE PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

To the President of the College:

I have the honor of submitting the following statement of the work of the department of English Language and Literature for the year 1885–86:

The aim of the department is, (1) to impart such a knowledge of the English language as will enable students to express their thoughts with correctness, clearness, force and so much of elegance as the subjects upon which they write or speak demand; (2) to teach the fundamental principles of composition, including both form and matter, with special reference to the collection and arrangement of details in description, narration and argument, so as to be most effective; (3) to cultivate in the student such control of himself and of his mental resources that he may present to his class or to a public audience, with suitable tone and action what he may have to say, whether the memorized thought of another or of himself, or the results of his extemporaneous effort; (4) to give a synoptical view of English Literature from Chaucer to the present time, attending with some carefulness to the characteristics of about twenty-five leading authors; (5) to acquaint students particularly with the greatest works of the greatest English authors, and thus develop a taste for refined thought, lofty sentiment and beautiful expression, and awaken such a love for what is best in our literature that the reading habit will not only be established but be given a strong impulse in the right direction.

To accomplish these ends the work is arranged in the following order: Three months of daily grammatical drill; six months semi-weekly exercises in elocution and declamation; three months elementary rhetoric daily with numerous written exercises in narration and description; three months weekly exercises of alternating essays and declamations; three months advance rhetoric daily with numerous exercises in analyses of propositions and fully written arguments; one year tri-termal exercises, partly public original speeches, partly expository essays on subjects assigned in the various departments of instruction, with weekly readings in Shakespere; three months daily history of English literature with critical essays; one year, weekly written exercises prepared from the critical study of masterpieces of literature and semi-annual public speeches; six weeks, daily study of longer works of the great authors, and one term weekly readings in Milton.

During the fall term of 1885 a class of 116 freshmen was committed to me for instruction in English language. They recited in two divisions, and with Whitney's Essentials of English as a guide, were taken step by step from the structure of the simple sentence through all the varieties of English construction. They were required to master the examples afforded by the text book, to furnish additional examples found in their general reading, and to construct sentences illustrating definitions and principles. The derivation and composition of words was the subject of special study, and special emphasis was laid on the formation of the verb and verb phrases. The last month additional material for analysis and parsing was furnished from the exercises in the class-book of elocution. Another year's experience shows the value of this course as a preparation for subsequent work.

This freshman class, with a few students who had entered the previous term, met with me in four sections during the week—one on Mondays, one on Tuesdays, one on Thursdays and one on Fridays, and in two sections on Saturday mornings for work in elocution and set declamations. Monroe's Vocal Gymnastics was used as a hand-book, and the exercises for vocal training were practiced as vigorously and thoroughly as the contiguity of other classes would allow. This was the first time systematic instruction in elocution had been made a part of the course, and it was gratifying to witness the enthusiasm of the students. Each member of the class declaimed three times, making 450 individual exercises. The selections were mostly from approved American orators, and poetry and nonsense were given no place.

On Thursday evenings, during the term, the juniors met in my class room and read Shakespere, critically, under my supervision, the play chosen being Othello. The seniors met with me Wednesday mornings for the reading of critical essays on the poems of the *romantic school*, specially Scott, Byron and Burns, and on the works of the contemporary American poets. The class numbered thirty-two, each presenting two essays. These essays were discussed in the class with reference to both form and matter, and the manuscript was afterwards carefully corrected by myself. During this term most of the seniors and juniors presented their public orations, all the details of which, from choice of subject to rehearsal of the speech, were worked up under my direction.

The English work of the sophomores was divided between Professor White and myself. The class numbered 56, each declaiming once before me, and presenting two essays on subjects previously assigned, to Prof. White. A class of ill prepared students, numbering 35, were given instruction in grammar during the term, by Mr. J. B. Cotton, under my supervision. The essays of the juniors were under the direction of Professor Bailey, and were on subjects assigned in connection with their study of horticulture.

The size of the sophomore class made it necessary, during the spring term, that I should be relieved from most of the work of the department, except the advance rhetoric and the written work connected with the instruction of the class room. In addition to traversing the text of A. S. Hill's "Principles of Rhetoric," each of the 58 students presented three argumentative productions, and the class met once a week, afternoons, for the study of Webster's Speech in Reply to Hayne. The juniors met Thursdays, as in the previous term, for reading Shakspeare ; this term reading The Tempest. The public speeches of the seniors and juniors were continued as last term. The essays of the juniors were in the charge of Dr. Abbot, and those of the seniors in hands of President Willits, and on historical subjects assigned from the work in Constitutional Law. The elocutionary work of the freshmen was done at a great disadvantage, being scattered among several officers, Professor Nelson, President Willits, Prof. Pattengill and myself. It is greatly to be desired that hereafter this term's work of the freshmen, which is an important one, be turned to good account.

A large accession, nearly 60 members, was made at the beginning of this term, to the freshman class. None of these students were prepared to advance with their class in English work. They were, therefore, excused from the afternoon labor, and I met them daily for eight weeks giving them practically the same instruction given to the class the previous term ; most of them were then able to pass their examination and advance with their fellows one term older. A few, specially in need of help, were instructed the entire term by Mr. Cotton.

During the summer term I had the junior class, numbering 28, in English Literature. Stopford A. Brooke's "Primer of English Literature" furnished the basis for daily class work, which was preceded by a few preparatory lectures and accompanied by brief informal lectures and illustrative readings. These were furnished by the series of English Classics of Clark and Maynard, with a few of the Clarenden Press series. Each student presented one critical essay, summarizing the results of the work of the class on some masterpiece read, and giving such additional criticism as he desired. Twenty seniors and specials elected the half term course in English Masterpieces, first offered this term. The selections studied were: The Areopagitica of Milton, the Speech on Conciliation of Burke, the Absalom and Achitophel of Dryden, the Essay on Man of Pope, the Childe Harold of Byron, and The Princess of Tennyson. All the seniors met with me once a week during the term for readings in Milton's Paradise Lost, the first four books being carefully studied, and passages read from some of the remaining books. The juniors continued their Shakspere work, reading this term Coriolanus, Lucrece and the Sonnets. The direction of the public exercises of the two higher classes, and the preparation of the commencement programme devolved upon me, as heretofore. The sophomores, numbering 40, presented before their class each one original oration, the direction of which is the same as for public occasions. Of the almost infinite work involved in the large number of these speeches, more than 150 of which have been delivered during the year, it is unnecessary to speak here, as I spoke of it at some length in my last report. The English work of the freshmen for the term, elementary rhetoric, was for the most part done by Mr. H. R. Pattengill; but as he was unable to remain the full term, the revision of essays assigned by myself after the close of his work, was done by Messrs. Lawrence McLouth and J. B. Cotton, under my supervision. The class numbered 85 and met in three divisions. They traversed the subject as presented in D. J. Hill's "Elements of Rhetoric," and each student presented three essays—(1) a description on a topic assigned by Dr. Beal in Botany; (2) a description on a topic selected by himself,; (3) a reproduction in prose of Longfellow's narrative from King Robert of Sicily.

It was my privilege to give one of the Wednesday afternoon lectures at the college, the subject being The Influence of Burns's Poetry, and to attend two of the winter institutes, at which I gave a lecture on Burns, the Peasant and Poet.

To you I am under great obligation for cordial support in my effort to make the work of this department throughout comprehensive and thorough; and specially for your prompt response to every request for assistance when the work has been more than I could do alone. Some maps, charts, and dictionaries have been placed in the class-rooms; an office has been furnished for me in College Hall; a permanent assistant, Mr. H. R. Pattengill, has been appointed, to do a share of the class-room work. But, owing to the large increase of students, and to the great proportion of English work coming in the two lower classes, additional permanent assistance is needed to carry forward the work as at present planned. The rhetorical exercises actually performed last year, including essays, declamations, speeches, and rehearsals, aggregated more than 2,000; and about one half of these were properly the work for a teacher of elocution. I recommend, therefore, that such an instructor be employed.

Another pressing need is suitable class-rooms. With much more use for class-rooms than any other department, we are more poorly equipped. At present, the small and inconvenient rooms in the third story of College Hall, which are in almost every way unsuitable, are the only quarters attainable. These are difficult of access, ill-ventilated, almost unendurably hot in summer, noisy during winds or storms, and away from the library, which is in constant demand. A good building should be provided, adjacent to the library, and containing suitable lecture-rooms and offices, and a general audience-room; or the Library building might be so extended as to furnish the same acommodations.

Respectfully submitted,

E. J. MacEWAN,
Professor of English Language and Literature.

Agricultural College,
October 1, 1886.

REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.

To the President State Agricultural College:

Sir:—Allow me to submit the following report of work done in the Veterinary department of this college for the years 1885–6:

With the beginning of the Fall term of 1885 the third course of lectures in Veterinary Science commenced. The instruction during this term was given to senior students, and, as on previous occasions, was devoted to veterinary anatomy, including a description of the various organs of the horse, ox, hog, and sheep. Towards the end of this term the students purchased a horse, which enabled us to do some practical work in anatomy, and which, I think, proved a great aid in fixing the healthy appearance of certain organs in the minds of those engaged in the work.

At the close of the term the class made a request that the examination in anatomy be held over till the spring, in order that we might have an opportunity of reviewing the subject with the aid of certain anatomical models, which were at this time in course of preparation for the department. The proposition was so much in accordance with my own views that I carried the matter before the faculty, and, after receiving their consent, the request of the students was granted, with, I think, the most satisfactory results.

The Spring term of 1886 may be looked upon as the most important epoch of our history in the Veterinary department up to the present, for it was at the beginning of this term that we took possession of our new quarters, "The Veterinary Laboratory," which, being well equipped, gave me an opportunity of conducting my exercises in a manner that I had not been able to do before, as I had at my command a very formidable nucleus of a veterinary museum, besides other conveniences for work in my line. The course of study was so like that of my last report that it scarcely requires description, except that I wish to add, that by having so much new equipment I was able to do the work in such a practical way that our daily exercises would hardly be recognized when compared with similar ones of the past, all of which, I trust, is to the advantage of our students.

During the Summer term the outline of our work was much the same as heretofore, but here again I have to speak of the advantages of our new equipment, as I was able to perform some operations before the class which I would not have attempted without it. I may add that I have great hopes that this method of illustration will keep increasing from year to year as the department becomes better known.

Besides operating before the class I was able to give some clinical instruction from cases that were brought to the Laboratory by neighboring farmers and others.

OUTSIDE WORK.

I delivered my Wednesday afternoon lecture in regular order, and issued the semi-annual bulletin according to the requirements of the last Legislature.

I attended to the veterinary requirements of live stock in the Horticultural and Agricultural departments of this college. I attended and spoke at those Farmers' Institutes that I was assigned to, and read papers at Breeders' Institutes in this State. In the capacity of State Veterinarian I have attended to the various duties required by that office. During the autumn of 1885 I was invited by the Agricultural Department of Purdue University to deliver a course of ten lectures upon veterinary subjects, at that institution, and speak at Farmers' Institutes in different parts of the State of Indiana, but previous engagements prevented my accepting their invitation.

In the winter of this year I was also requested to attend the Wisconsin Dairyman's Association, and repeat a discourse upon matters pertaining to dairy cattle, which I had previously delivered to the Northwestern Dairyman's Association, at Mankato, Minn., but the time of the meeting clashed with our own institutes, so I was unable to attend the Wisconsin convocation. I was also invited by the University of Minnesota to take part in Farmers' Institutes in that State, but in this case I had also to decline, as the day they wished me to commence the work was the opening day of our own college.

During the month of September, 1886, I prepared an exhibit from the Veterinary Department, to be shown at the State Fair, in Jackson, and also at the Central Michigan Fair, at Lansing, and on both occasions, I have been told, considerable interest was expressed by visitors at the display.

Very respectfully submitted by

Yours Obediently,

E. A. A. GRANGE,
Professor Veterinary Science.

AGRICULTURAL COLLEGE, MICH.,
October 1, 1886.

REPORT OF PROFESSOR OF MILITARY SCIENCE AND TACTICS.

Hon. Edwin Willits, President Michigan Agricultural College:

SIR—I have the honor to render, for your information, the following report of the condition of the Department of Military Science and Tactics for the year ending September 30, 1886:

Practical and theoretical military exercises have been held as follows:

Number of infantry drills, lasting one hour, with an average attendance of 100 students	157
Number of dress-parades, lasting one-half hour, with an average attendance of 80 students	20
Number of recitations in Upton's Infantry Tactics, with an average attendance of 12 students	63

Number of target practices, lasting three hours, with an average attendance of 14 students	6

On July 13, 1886, I delivered a public lecture in the chapel, entitled, "The English Soldier in Bermuda." On September 29, 1886, I delivered a lecture to my class in Tactics on "The Duties of Guards and Sentinels."

On Decoration Day (May 30, 1886,) the Cadets accepted an invitation to march in the street parade in Lansing, and made a creditable appearance.

Fifty-seven of the cadets, fully uniformed and equipped, attended the State Fair, at Jackson, on September 16 and 17, 1886. Of this number a company of thirty, commanded by Cadet Captain Irving B. Bates, participated in the street parade and drill on the 17th. Of this company the Detroit Free Press of the 18th of September, spoke as follows:

"The agricultural boys came in next. Dressed in blue and with the whitest of white gloves, they presented a very fine appearance. Their manual was manual, indeed. The marching of the cadets was precision from first to last."

Since my last report the College Armory has been completed, and the number of cadet Springfield rifles, loaned by the War Department, has been increased to 150. The Armory is satisfactory in all respects for military purposes.

Discipline among the cadets, during the hours when they have been subject to my control, has been good. They have shown great interest and aptitude at drill and are never disobedient or insubordinate.

RECOMMENDATIONS.

I respectfully repeat my recommendation of last year that every student shall be required to drill two years as a condition for graduation, and that the Legislature be requested to confer the brevet rank of Second Lieutenant in the M. S. T. on all graduates of the college who earn this honor.

I recommend that the cadets go into camp for one week during the summer, at some place in the vicinity of the college. Tents for the purpose would doubtless be supplied by the State Q. M. Dept.

Lastly I suggest that a suitable house be provided at the college for the use of the Professor of Military Science and Tactics. Since the State receives his services *gratis* he should at least be comfortably quartered. My successor will reap the benefit of this suggestion, if it is acted upon, as my own connection with the college will, by operation of law, probably cease during the coming year.

Very respectfully, your obedient servant,

J. A. LOCKWOOD,
2d Lieut. 17th U. S. Infantry,
Professor of Military Science and Tactics.

MICHIGAN AGRICULTURAL COLLEGE,
October, 1886.

REPORT OF THE LIBRARIAN.

To the President:

The year just closed has been one of uninterrupted prosperity and growth; the use of the library by the students is a gratifying indication of their appreciation of the privileges it affords; there have been drawn from the library for use outside of the building 2,900 books and at least five times as many are consulted within the library during the day; the loss and defacement of books has been so slight as to be hardly worth mentioning, not above three books having been lost during the year and no case of wilful defacement occurring; the utmost freedom is granted readers and nothing which the library affords either of books or periodicals is in any way withheld from them, they having access to all collections at all times; there have been added by binding 132 volumes; by purchase 542 volumes; by gift 200 bound books and 260 pamphlets, making an increase for the year of 1,134 volumes and a total collection of 9,820 books and pamphlets, or 8,348 bound books and 1,472 pamphlets.

All duplicate documents, except one set of Annals of Congress, have been returned to the department of the interior with the understanding that, as fast as possible, an equal number of volumes shall be returned to us for the completing of our sets.

In the same way a large number of, to us, comparatively valueless reports have been sent to the State departments, especially to the department of public instruction; by this means our shelf room has been materially increased.

The gifts to the library, together with the names of the donors, are as follows, viz:

BOUND DONATIONS.

Agricultural Reports from the States in Order.

California, 1885—Edwin F. Smith.
Connecticut, 1885—T. S. Gold.
Georgia, 2 volumes, 1884—H. G. Reynolds.
Iowa, 1881–2–3–4—John R. Shaffer.
Kansas, 1873—H. G. Reynolds.
Maine, 1881–2–3–4—H. G. Reynolds.
Massachusetts, 1881–2–3–4–5—H. H. Goodell.
New Hampshire, Vols. 13–14—Dartmouth College Library.
New Jersey, 1885—W. A. Taylor.
New York, 33d report—T. L. Harrison.
Pennsylvania, 1879, 1884—State College.
Vermont, 8th report—Prof. J. E. Goodrich.

Agricultural Experiments—Reports from the Following:

Alabama, California, Connecticut, Colorado, Cornell University, Georgia, Kansas, Louisiana, Manitoba, Massachusetts, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Purdue University, Wisconsin.

Miscellaneous.

American Chesterfield—W. E. Gilbert.
A Political Crime—A. M. Gibson.

Biography of a Slave—Prof. E. J. McEwan.
California Geological Survey of, 2 volumes—E. M. Preston.
Child's Health Primer—Annis M. Hood.
Colorado Horticultural Reports, 1882-3-4—President Ingersoll.
Colorado Railroad Report, 1885—President Ingersoll.
Down the Ravine—F. S. Kedzie.
Horticultural Resources of Nevada County—E. M. Preston.
Illinois Industrial Report—Prof. T. J. Burrill.
Massachusetts Bureau of Labor, 3 volumes—Carroll D. Wright.
Medieval and Modern History—Ginn & Co.

Michigan.

Auditor General's Report, 1885—Hon. W. C. Stevens.
Board of Health Report, 1884—Dr H. B. Baker.
Documents from above—Dr. H. B. Baker.
Charities, 12th Rept.—Commissioner.
Insurance—Commissioner Walker.
Joint Documents, vols. 1, 2, 3, 4—Hon. H. A. Conant.
Labor Bureau, 3d Report—Hon. C. V. R. Pond.
Pioneer Collections, vols. 5 and 6—Mrs. H. A. Tenney.
Public Acts—Hon. H. A. Conant.
Supreme Court Reports, vols. 53, 54, 55, 58—Mrs H. A. Tenney.
Territorial Laws, 4 volumes—Hon. H. A. Conant.

Miscellaneous documents, 24 vols.—Hon. H. Chamberlain.
Natural History, New York, vol. 3—Prof. L. H. Bailey.
New York Meteorological Observations—Daniel Draper.
Smithsonian Institute Report, 1884—Spencer F. Baird.
Springfield Rifle Management—Lieut. Lockwood.
Tennessee State Board of Health—J. B. Lindsley, M. D.

United States Documents.

Agriculture, Report of, 1885—Hon. N. H. Coleman.
Astronomical and Meteorological Observations, 1881-82—Navy Department.
Bureau Animal Industry, 2d Report—D. E. Salmon.
Bureau Labor, vol. 1—Carroll D. Wright.
Congressional Records, 64 vols.—Department Interior.
Congressional Record, 11 Reports—Hon. E. B. Winans.
Descriptive Catalogue govt. publications—Dept. Interior.
Education, Report of commissioner of, 1883-84—John Eaton.
Engineer, Report of Chief of—War Department.
Forestry, 1884—G. B. Loring.
Geographical Survey, W. 100 M.—War Department.
Labor Bureau, 1st Report—C. D. Wright.
Nautical Almanac, '87—Navy Department.
Official Record War of Rebellion, Vols. 13-14-15-16-17—War Department.
Ordnance Report, Chief of—War Department.
Senate and House Journals—Department of the Interior.
Signal Service, 1884—War Department.

Foreign Exchanges.

Acta Academia Natural Curiosorum, 13 Vols.—Halle University.

Annuario Academio Polytechnica do Porto.—Academia Polytechnico.

Bulletin de la Society centrale d'Agriculture de L'Herault—Louis Vialla.

Bulletin du Comice Agricole Central du Department de la Loire—Inferieure 1883–4–5—M. Andouard.

Canada, Geological Survey, 24 vols—J. Thorburn.

India, Meteorological Report of, 1884—Henry F. Blanford.

India, Report department Revenue Settlement and Agriculture, 1884–5—Hon W. Wilson.

Journals of the Legislative Assembly, Quebec and Journals of Council—Theodore Robitaille.

La Mouche du Narcisse and sixteen other pamphlets—Dr. J. Ritzema Bos.

R. Istituto Lombardo di Scienze e Lettere, 1884—President Schiaparelli.

Sessional papers, Ontario—J. J. Ross.

Statutes of Manitoba—James Cox Aikin.

Verslag over deu landbouw in Nederland, 1881–2–3—Library, Wageningen.

Water Supply, Victoria, Australia—Hon. A. Deakin.

Pamphlets.

American Short Horn Breeders' Association Circulars.

Bailey, Prof. L. H.—Fruits and fruit trees of America.

Bailey, Prof. L. H.—Plantæ Texanæ.

Burrill, Prof. T. J.—Pamphlets from Illinois Laboratory.

Carpenter, L. G.—Artist Life, W. B. Conely.

Carpenter, L. G.—Brief review of the ten years' work of Johns Hopkins University.

Cragin, Frank W.—Natural history bulletins, Washburn College.

Draper Daniel—Report of the New York Meteorological Observatory, 1885.

Eaton, John—Historical sketches, universities and colleges.

Eaton, John—Outlines for Museum of Anatomy.

Eaton, John—Resena Sobre el cultero de Algunas Plantas Industriales.

Eaton, John—Datos Mercantiles relativos al Puerto de Vera Cruz.

Eaton, John—El Algodonero.

Eaton, John—Estudio Qunico, Industrialde los varios Products del Magney Mexicano.

Eaton, John—Cuadro geografico, estadistico, Descriptivoe Historico de los Estados unidos Mexicanos.

Eaton, John—Riqueza Minera de Mexico.

Essex Institute—Bulletins of Essex Institute, Massachusetts.

Fairchild, Rev. J. H.—Michigan Baptist Anniversaries, 1885.

Folwell, W. W.—Bulletin Minnesota Academy Natural Science.

Forbes, S. A.—Illinois natural history bulletins.

Garfield, Charles W.—Report of the American Pomological Society, 1885.

Hilgard, Prof. E. W. Viticultural Work, California, 1883–5.

Ingersoll, President C. L.—Eleven pamphlets on Colorado.

Jesup, M. K.—Twenty-two numbers American Museum Natural History.

Lansing Woman's Christian Temperance Union—Report of State W. C. T. U., 1885.

Lansing Woman's Christian Temperance Union—White Cross series.

Manitoba—Report of Department of Agriculture.
McCurdy, Charles W.—Report of Sand Beach schools.
Newcomb, Simon—Astronomical papers, 1 volume.
Pond, Bertie—Ten reports State charities.
Potts, William—Sixty pamphlets on civil service.
Ritch, G. W.—Illustrated New Mexico, 1883.
Sanborn, J. W.—Annual report State Board of Agriculture, Missouri.
Spaight, A. W.—Resources, soil and climate of Texas.
Thompson, Rev. E.—Proceedings of 51st annual convention Diocese of Michigan, 1885.
Tracy, Prof. S. M.—Catalogue phaenogamous and cyptogamous plants of Missouri.
Tryon, J. H.—Practical treatise on grape culture.
United States—Astronomical papers, volume 3, part 4, Navy Department.
United States—Consular reports, six, State Department.
United States—Currency, report comptroller, Treasury Department.
United States—Forestry, proceedings of American Congress.
United States—Official Army Register, War Department.
United States—Official Gazette, Patent Office.
United States—Statistical Abstract of the United States, Treasury Department
Wellcome, Mrs. M. D.—Talks about flowers.
Wright, Carroll D.—Sixty-seven pamphlets on civil service.

The system of foreign exchanges is bringing to us a fine collection of exceptionally well illustrated articles upon scientific subjects, many of them directly in our lines of study; seventy reports were sent abroad to schools of agriculture and experimental stations, and to a few individuals who asked to receive them in exchange for other matter.

The reading-room has had an increased number of periodicals, as shown by the succeeding list:

Foreign, by subscription.

Agricultural Gazette,
Anglia,
Annales de Chimie et de Physique,
Art Journal,
Chemical News,
Engineering,
Englische Studien,
Garden,
Gardener’s Chronicle,
Journal of Anatomy,
“ “ Chemical Society,
Journal of Forestry,
“ “ Royal Agr’l Society,
Knowledge,
Nature,
North British Agriculturist,
Observatory, The,
Spectator,
Sotheran’s price current of books,
Times, Weekly, London,
Veterinarian,
Veterinary Journal.

American, by subscription.

American Agriculturist,
" Bee Journal,
" Architect and Building News,
" Chemical Journal,
" Cultivator,
" Garden,
" Journal of Science,
" " Comparative Medicine and Surgery,
" Library Journal,
" Machinist,
" Meteorological Journal,
" Microscopical Journal,
" Naturalist,
" Veterinary Review,
Andover Review,
Annals of Mathematics,
Army Journal,
Art Amateur,
Atlantic Monthly,
Banker's Magazine,
Blackwood's Magazine,
Boston Journal of Chemistry,
Botanical Gazette,
Breeder's Gazette,
British Quarterly Review,
Canadian Entomologist,
Century Magazine,
Chicago Tribune, daily,
Christian Union,
Contemporary Review,
Country Gentleman,
Critic,
Detroit Free Press, daily,
Detroit Tribune, daily,
Dial,
Education,
Electrical World,
Engineering News,
Entomologica Americana,
Gardener's Monthly,
Harper's Monthly,
" Weekly,
Iowa Homestead,
Iron Age,
Journal Franklin Institute,
Journal of the Military Service Institution,
Literary World,
Littell's Living Age,
MacMillan's Magazine,
Magazine of American History,
Manufacturer and Builder,
Mathematical Magazine,
Mechanical Engineer,
Metal Worker,
Michigan Farmer,
Michigan Horticulturist,
Microscope, The,
Mirror and Farmer,
National Live Stock Journal.
New England Homestead,
New York Independent,
" " Nation,
" " Tribune,
North American Review,
Ohio Farmer,
Outing,
Popular Science Monthly,
Poultry World,
Prairie Farmer,
Rural New Yorker,
Sanitary Engineering,
Sanitary News,
Science,
Science Observer,
Scientific American,
Scientific American Supplement,
Shakspeariana,
Sidereal Messenger,
Southern Cultivator,
U. S. Govt. Pubs. Mo. Catalogue.
Westminster Review,
Van Nostrand's Magazine,
Vick's Monthly.

Donated by publishers or others.

Albion Republican,
Allegan Gazette,
American Beekeeper's Mazazine,
" Chemical Review,
" Dairyman,
" Farmer,
Appleton's Literary Bulletin,
Battle Creek Journal,
Bee and Poultry Magazine,
Benton's Bees,
Cincinnati Grange Bulletin,
Charlotte Republican,
Charlevoix Journal,
Chicago Medical Times,
Christian Register,
Clinton Independent,
Coldwater Republican,
City and Country,
Deaf Mute Mirror,
Drainage and Farm Journal,
Duncan's Monthly Magazine,
Farm, Field and Stockman,
Farm and Fireside,
Farmer's Advocate,
Farm, Herd and Home,
Farm Home,
Flint Globe,
Fruit Grower's Journal,
Good Health,
Grand Rapids Times,
Grand Haven Herald,
Grand Traverse Herald,
Grange Visitor,
Hillsdale Leader,
Hillsdale Standard,
Holstein Friesian Record,
Imports and Exports to U. S.,
Industrialist,
Ingham County News,
Ionia Sentinel,
Journal D'Agriculture,
Journal N. Y. Microscopical Society,
Kalamazoo Telegraph,
Lansing Journal,
Lansing Sentinel,
Locomotive,
Michigan Horticulturist,
Michigan Tribune,
Microscope, The (Detroit),
Midland Republican,
Midland Sun,
Monroe Commercial,
Naturalist's Bulletin,
New England Farmer,
Official Gazette,
Ouray Times,
Our Young People,
Owosso Times,
Paw Paw True Northerner,
Planter and Stockman,
Popular Gardening,
Practical Farmer,
Saginaw Morning Herald,
School Moderator,
Scientific Roll,
Sorghum Grower's Guide,
St. Louis Leader,
State Republican (Lansing),
The Center,
The Hog,
Three Rivers Tribune,
Traverse Bay Eagle,
Union Signal,
Watchman,
Weekly Globe and Canada Farmer,
Wolverine Citizen.

From the above lists we count 180 periodicals in the reading-room during the year, and there are always to be had on the tables numerous scientific or political pamphlets on the topics of the times. The library has been open sixty-two hours a week, ten hours daily on week days, two hours on Sunday, and the number of readers compares very flatteringly with other libraries visited.

A trial has been made of the system of loaning a second book upon the personal request of the student wishing it, and the success of the experiment justifies a continuance of the method.

The rooms have been made more cleanly and quiet by the linoleum cover, which conduces greatly to our comfort.

The east wall has been enriched by an oil portrait of Dr. Abbot, presented to the college by the alumni of the institution.

A foreign student, who does not want his name disclosed, gave, during the autumn, a sum of money to be invested in something of permanent value to the students. After some deliberation it was decided to place in the library a collection of uniformly bound English classics, which will, in due time, be done.

Your attention was called last year to the need for additional shelf room within the two years to come, and some outlay for this purpose will be necessary.

With the increased number of students there has been a large amount of labor suitable for students to do, and they have been employed regularly to perform certain kinds of work, doing their duties always in a manner to merit the highest praise.

Respectfully submitted,

M. J. C. MERRELL,
Librarian.

FARMERS' INSTITUTES.

The following series of Farmers' Institutes was held under the auspices of the State Board of Agriculture during February, 1886:

Hudsonville, Ottawa Co., Feb. 2 and 3, attended by Professors W. J. Beal, R. C. Carpenter and Samuel Johnson.

Rochester, Oakland Co., Feb. 4 and 5, attended by Professors R. C. Carpenter, E. A. A. Grange and R. C. Kedzie.

St. Louis, Gratiot Co., Feb. 9 and 10, attended by Professors Lewis McLouth, A. J. Cook and W. J. Beal.

East Saginaw, Saginaw Co., Feb. 11 and 12, attended by Professors R. C. Kedzie, E. A. A. Grange, Lewis McLouth and F. S. Kedzie.

Grass Lake, Jackson Co., Feb. 15 and 16, attended by Professors Samuel Johnson, E. J. MacEwan, L. H. Bailey, Jr., and F. S. Kedzie.

Quincy, Branch Co., Feb. 17 and 18, attended by Professors A. J. Cook, E. J. MacEwan, L. H. Bailey, Jr., and L. G. Carpenter.

President Edwin Willits and Secretary H. G. Reynolds also attended each of the Institutes.

HUDSONVILLE INSTITUTE.

The pleasant hall of the Hudsonville Grange was filled to overflowing at each of the sessions indicated in the following program:

TUESDAY, FEBRUARY 2, 7 P. M., 1886.

Meeting called to order by H. E. Hudson.
Music.
Prayer by the Rev. H. C. Hurlburt.
Introduction by R. Alward, President.
Music.
Address of welcome by H. D. Weatherwax.
Music.
Drainage—By Prof. R. C. Carpenter.
Essay, " Living for an Object "—Miss Helen Corwin.
Music and Dismissal.

FEBRUARY 3, 9 A. M.

Music.
Prayer by Rev. H. C. Hurlburt.
Disease of Potatoes—By A. A. Crozier, Grand Rapids.
Cattle and Dairy Products, by Prof. Samuel Johnson, Agricultural College.
Paper—Mr. Geo. Sinclair—The Dairy.
Music and dinner at the hall.

1:30 P. M

Music.
Farmers' Organizations—President R. Alward.
Red Clover and its Uses—Prof. W. J. Beal.
Effects of Primary Schools—Chas. Freeman.
Rehearsal—Miss Allie Alward.
Music.
Legislation for Farmers—Hon. Geo. F. Richardson, Jamestown.
Response—Gerrit Vanschleven, Holland.
Essay—Mrs. A. V. Weatherwax, Georgetown.
Music.
Lunch at the hall.

7 P. M.

Music.
Essay, by Chas. Underhill, of Hudsonville.
Hygiene, by B. B. Godfrey, M. D., Hudsonville.
Music.

Music was furnished by the Georgetown and Hudsonville Glee Clubs, and a most abundant lunch by the ladies of the Hudsonville Grange.

The various papers read at this and the other institutes were followed by discussions, which will be found in connection with the papers themselves in the pages following this account of the general proceedings. The general remarks made by President Willits will be found collected as one paper in the same place.

The remarks made by Hon. Geo. F. Richardson, President Willits, Secretary Clark and others on Taxation, Butterine, Railroad and Patent Right legislation will be found in the discussion following President Alward's paper on Farmers' Organizations.

Owing to the next Institute being appointed on the opposite side of the State it was necessary for the representatives of the College to leave before the final session, which was specially signalized by a paper by Dr. B. B. Godfrey on Hygiene.

ROCHESTER INSTITUTE.

PROGRAM.

THURSDAY, FEBRUARY 4, 10 A. M.

Music—Double quartet.
Prayer—Rev. J. P. Fryer.
Opening Address—J. M. Norton.
Paper: Can Farming be made Profitable on the Average Farm?—J. J. Snook, Rochester.
Music.

AFTERNOON SESSION, 1:30 P. M.

Music.
Paper: How Shall We Improve Our Common Cattle?—Edwin Phelps, Esq., Pontiac.
Essay—Mrs. L. E. Cannon, Washington.
Lecture: What Can be Done with the Muck Swamps?—Prof. R. C. Carpenter, Agricultural College.
Music.

EVENING SESSION, 7 O'CLOCK

Music.
Paper—Hon. Wm. Ball, Hamburg.
Essay: Practical Culture—Mrs. T. B. Fox.
Lecture: Nitrogen, the Fertilizing Element—Prof. R. C. Kedzie, Agricultural College.
Music.

FRIDAY, FEBRUARY 5, 10 A. M.

Prayer—Rev. Wm. G. Roberts.
Paper: Our Common Schools—J. Van Hoosen, Rochester.
Paper: The Wilds of Michigan—George H. Cannon, Washington.
Music.

AFTERNOON SESSION.

Paper: Oleomargarine and Butterine—What Shall Farmers Do About It?—Charles Adams.
Essay—Mrs. J. C. Wilson.
Lecture—Dr. E. A. A. Grange, Agricultural College.
Music.

EVENING SESSION.

Music.
Prayer—Rev. W. H. Mills.
Paper—Evolution in Farming, J. H. Peabody.
Closing Address—President Edwin Willits, Agricultural College.
Music.
Discussions following each paper and lecture.
Local committee—M. P. Newberry, J. M. Norton, H. J. Taylor, Mrs. L. Woodward, Mrs. J. J. Snook.

This Institute was held in the Palmer rink, a building so large that even the 600 persons in the audience seemed almost lost in the space around them.

The exercises were opened, after an introduction by President Van Hoosen, with some very good music and an address of welcome by Hon. John M. Norton who, in the course of his remarks, expressed the purpose of the gathering most happily in these words:

The object of this meeting is to mutually blend our experiences and aid each other in finding out the secrets of success and profit in farming.

I believe in the two days before us, we shall glean information which, when practically applied, will add to our profit and store in farming. Let discussion be free and untrammeled by timidity, literary or social distinction. A word from a practical, uncultured farmer, may lead the thought of the more cultured minds to the treatment and solution of some essential facts in nature, on which hangs success or failure in any given lines of production.

We welcome you all, and solicit your attention and interest to all subjects which may be considered by the institute.

The program was carried out substantially as printed, and the institute was pronounced a grand success. Much praise is due to the local press for the completeness of their reports, the Utica Sentinel, the Pontiac Gazette and the New Era, each having admirable and very full reports.

The various discussions will be found following the papers which called them out, except one consisting mainly of questions addressed to Dr. Kedzie, which will be found after his paper on Nitrogen.

ST. LOUIS INSTITUTE.

The sessions of this institute were held in Holcomb's Opera House, a large hall, which was well filled most of the time.

PROGRAM.

Tuesday Evening, 7 o'clock.

Music.
Prayer.
Music.
Address of Welcome, by President Parker Merrill.
Response by Chairman of Institute, Hon. C. H. Morse.
"Industrial Geology"—Prof. Cook, Agricultural College.
Discussion.
Poem—"The American Bird," Judge G. T. Brown.
Music.

Wednesday, Feb. 10, 9:30 A. M.

Music.
Paper—"Pasture," Darius Reid.
Discussion, opened by Roman Fyler.
Paper—"The Best Racket," Geo. Fred Lewis.
Discussion.
"Red Clover," Prof. Beal, of Agricultural College.
Discussion.

Afternoon, 1:30.

Music.
"Four Remedies for Insect Ravages," Prof. Cook.
Discussion, by Elias Shaw.
Paper—"Sheep Husbandry," Wm. Long.
Discussion.
Paper, by T. J. Tann.
Discussion.

Evening, 7:15.

Music.
"Our Debts to Inventors and Mechanics." Prof. McLouth, of State Agricultural College.
Discussion.
Address, by Hon. Edwin Willits, President State Agricultural College.
Closing Remarks.
Music.

I quote from the St. Louis Leader's report of the Institute: President Parker Merrill in a few appropriate words welcomed the first State Farmers' Institute to St. Louis and Gratiot county. He said he considered it a high compliment to the energy and enterprise of our county that the State department of agriculture had seen fit to appoint an institute here, and predicted that it was only a stepping stone to still greater success and prosperity for the thrifty and growing county of Gratiot. Again he welcomed the instructors and the audience to the hearts and homes of St. Louis.

Chairman Morse accepted the welcome in the spirit in which it had been tendered. He had understood that the institute was very largely the conception of St. Louis men; he was glad it had been arranged for, as the interests of the town and the farmers are so closely connected that what is for the interest and benefit of one is also for the good of the other, for if the farmers are thrifty and prosperous the merchants and business men of the town are also prosperous. He had not been so well acquainted at St. Louis as in some other parts of the county, but had always heard a good report of the town and its people. In military parades and Fourth of July celebrations he had often been annoyed that so many of the people, asserting their rights as American citizens, persisted in standing on the sidewalk to see the procession go by. "If the people in this county will help all in their power the institute can be made a success, but if you all persist in standing on the sidewalk while the procession goes by, let me tell you, there will not be much of a procession."

He was glad that while we couldn't all go to the agricultural college the college had come to us, and he was reminded that in the matter of Clawson wheat alone, which was at first condemned, until finally Prof. Kedzie energetically took up the fight for this variety, and soon it became the most profitable wheat in the State, until more had been saved to the State by this variety of wheat than had been voted to and expended by the college from its foundation to the present time. He always felt like taking off his hat and standing uncovered in the presence of the old veterans who came to the howling wilderness of Michigan in 1852, and with strong arms and willing hearts have made the wilderness to blossom as a rose. Many of those pioneers are still here and some, he was glad to know, were here to take part in the deliberations of this institute.

The first session closed with a most amusing poem by Judge Giles T. Brown, on "The American Bird," setting forth the superior merit of the thanksgiving turkey as compared with the fancied virtue of the eagle. The second session opened with a paper by Mr. Geo. F. Lewis, secretary of the North Eastern Agricultural Society of Michigan, on "The Best Racket," exalting the farmers' calling and illustrating his paper by many extempore narratives. He said farmers should consider the comfort of their own homes as the chief reward or possibility of their lives. Their wives should have things a little better than themselves. They should have the best turkey on their own table, the driest fuel piled away in the woodshed, the purest water in their well and their home sheltered by beautiful trees, either those of nature's planting or if these had been destroyed, such as could be transplanted from the woods. This object, the speaker showed to be entirely within the reach of every farmer.

President Willits: I have enjoyed Mr. Lewis' remarks and agree with most of them.

Unquestionably the best product of this earth is men and the farmers are the best of these.

In New York, the best of their merchants grew up on farms.

Of the lawyers of the country nine-tenths of the best were raised on the farm.

I do not say that necessarily farmers are more intellectual or honest than other men, but there is something in the necessary small economies and the early rising, the hard work and close thrift that give the habits that win success. Hence I am a strong believer in the benefit to the country of an intelligent farming community as its basis. It is such a community that raises the most intelligent lawyers, doctors and clergymen.

Not having been able to secure Mr. Reid's paper on pasture for publication, I have incorporated the discussion which it drew out with that which follows Dr. Beal's paper on red clover, which will be found later on in this volume.

VALUE OF PINE STUMP LAND.

Before settling for the regular program of the afternoon session a short discussion on this subject took place.

President E. Willits: I am told that there are many thousand acres of pine land north of here which, when stripped of their pine will not be worth their taxes. Is this true? If so, is there no remedy? Next year we purpose to hold at least two Institutes in these regions. Possibly this land may not have native fertility and yet be amenable to the influences of fertilizers, or it may be redeemable by grasses and be available for pasture or dairy purposes.

Will some one enlighten us on this subject?

Hon. C. H. Morse: I have fifteen acres of pine stumps which yielded 100,000 feet of pine per acre. I cleared and began cropping the piece twelve years ago.

The first crop was wheat—only ten bushels per acre.

The second crop was wheat, self sown, but with a little manure was somewhat better than the first.

I have taken twenty-two and one-half bushels of wheat per acre from among those stumps.

Two years ago the field was in clover and two hundred sheep and sixteen head of cattle made very little impression upon it.

Last year I took 75 bushels of corn per acre from among those same stumps.

That land is very far from worthless. It needs culture and manure, but chiefly it needs to be freeed from the stumps.

Pres. Willits: What is the soil?

C. H. Morse: Sandy, mixed with gravel, with no clay subsoil.

Pres. Willits: Have you travelled through lands that are called worthless pine lands?

C H. Morse: Yes, I have, and I think they are a good deal the same as these I have described.

Pres. Willits: They tell me that there are large tracts which will only yield two or three crops and after that must be abandoned?

C. H. Morse: Across the fence from me are lands originally like mine, which have been cropped to death, and which now will not raise white beans; and yet if the stumps were out of it I would as lief farm on that soil as on any other.

Dr. Beal: What is the cost of stumping such land?

C. H. Morse: I do not know. Dynamite is of no use in sand; but the stumps are worth almost what it costs to get them out for fencing because they will last forever, as the small boy said he knew to be the case, as his father had tried it twice.

Query: Would $25 per rod build that fence?

C. H. Morse: I would give $1 per stump to get them out and it would cost all that the land is worth.

H. L. Holcomb: The white sands are really worthless unless for the growth of some kinds of timber. After the pine is cut it comes up first to briars and then to poplar.

But all pine land is not of that kind by any means. I cut some pine near Edmore, put the land into wheat and got twenty-four bushels per acre. I have now one hundred and twenty acres of that land from which I took three successive crops of clover and timothy, the last not as good as the first and second only amounting to ninety tons from the one hundred and twenty acres. All the pine land around Edmore is of this character. With the stumps out it would be very valuable, but how to get them out I do not know.

S. S Hastings: I stumped three acres for $40, at fifty cents per stump.

S. Moody: I have seen many pieces of pine land with clay subsoil that were good and worth stumping.

The stump fence can be made for $4 per rod.

Dr. Beal: Cannot the winter season be put in to advantage in stumping?

Mr. Shaw: In Midland, there are many screw stump machines that work whenever the ground is not frozen, with one horse at the machine and three or four hauling and making fence.

Mr. R. H. Allen: In York State we had a machine that would cost $300, that would draw from forty to fifty stumps a day, according to size. As soon as pulled and cleaned one team will draw the stump to the fence and two to four stumps will make a rod of fence. We used to pull for twenty-five to fifty cents per stump and our board, three horses and three men. It drew by tackle power that lifted the stump right up. It was the Johnson & English machine.

The exercises of the afternoon closed with a humorous paper on "Pioneer Reminiscences," by T. J. Tann, in which he told how he tried to shoot a squirrel and missed him.

The St. Louis Leader says of the evening session: "A crowded house greeted Rev. Theo. Nelson, who opened the session with prayer, the St. Louis orchestra furnished some excellent music, and then Prof. McLouth read a most happy and interesting paper on "Our Debts to Inventors and Mechanics."

After which President Willets gave a somewhat full account of the Agricultural College.

After sundry complimentary speeches and resolutions the session closed.

EAST SAGINAW INSTITUTE.

PROGRAM.

First Session — February 11, 7 p. m.

1. Music.
2. Opening Prayer.
3. Welcoming Address by the Chairman.
4. Paper — "Relations of Veterinary Science to Agriculture," by E. A. A. Grange, Professor of Veterinary Science, State Agricultural College. Discussion.
5. Paper — "Legal Advice to Farmers," by Hon. W. S. Tennant. Discussion.

Second Session — February 12, 9 a. m.

1. Paper — "Wheat Culture in Saginaw County," by Dennis Bow, of Bridgeport. Discussion.
2. Paper — "How to work Light Soils," by David Geddes, of Swan Creek. Discussion.
3. Paper — "Gumption," by Hon. G. F. Lewis, of Saginaw City. Discussion.

Third Session — February 12, 2 p. m.

1. Music.
2. Paper — "Roads and Roadmaking," by T. Appleton, Esq., City Engineer of East Saginaw. Discussion.
3. Paper — "Nitrogen," by R. C. Kedzie, M. D., Professor of Chemistry, State Agricultural College.
4. Paper — "Dairy Interests in the Saginaw Valley," by Hon. Wm. L. Webber. Discussion.
5. Paper — "Fruit on the Farm," by E. F. Guild, East Saginaw. Discussion.
6. Paper — "Diversities of Nature, as exemplified in the Occupations of the Farmer," by Robt. Ure, of Saginaw. Discussion.

Fourth Session — February 12, 7 p. m.

1. Music.
2. Paper — "Mechanics and Agriculture," by Prof. McLouth, of the Agricultural College. Discussion.
3. "Exhibition of Views of the State Agricultural College, with the Stereoptican," by Frank S. Kedzie, Assistant Professor of Chemistry, State Agricultural College.
4. "Talk by Hon. Edwin Willets, President State Agricultural, concerning the objects and methods of the College."

Mayor Estabrook, as chairman, in extending a welcome to those in attendance upon the Institute, said: * * * * "We welcome you to our midst; we welcome you not merely to the city of East Saginaw, but to the cities of the Saginaw Valley. And what is the Saginaw Valley? Not merely the land along the banks of the Saginaw river. It may be a misnomer to call it a valley. Did you ever look at the map of Michigan and learn what a vast part of the Lower Peninsula the Saginaw river drains? Parts, or all of Huron, Tuscola, Sanilac, Lapeer, Genessee, Oakland, Shiawassee, Livingston, Montcalm, Gratiot, Mecosta, Isabella, Clare, Midland, Roscommon, Gladwin, Osceola, Ogemaw, Bay, Saginaw—an area equal in extent to some of the great kingdoms of the Old World. Much of this is yet undeveloped, but within this territory lies what, in my judgment, will one day be the best agricultural section of the State. All this is drained through the Saginaw river and its tributaries, which, taken together, resemble an apple tree, the trunk of which is the Saginaw river, the Cass, Flint, Tittabawassee, Shiawassee, Pine and Chippewa being the branches, and is not this the agricultural Saginaw Valley?

We especially welcome you to Saginaw county, as being the center and heart of this great valley. If I had the time, I would gladly have given figures to show the growth of *all* this country. I will give a few showing the increase of land cleared, valuation of real and personal estates, and population in this county since 1860:

Acres of land cleared in 1860	18,048
" " " " " 1870	33,383
" " " " " 1885	132,434

From a total of 254,191 acres 3,335 farms averaging over 75 acres each.

In valuation, 1850	$471,707 27
" " 1860	2,554,484 22
" " 1870	9,647,260 20
" " 1880	17,997,451 52
" " 1885	22,666,857 94
In population, 1860	12,493
In United States census, 1880	59,145
In State Census, 1884	75,813

As late as 1860 the general impression in regard to the Saginaw Valley, shared by many residents and a large majority of outsiders, was that while the timber was valuable, that by reason of the swamps and marshes, the sterility supposed to attach to lands in pine districts, the liability of frosts, the lack of drainage, and the unusual difficulty in clearing, it could never become even a moderately productive farming district. This doubt and the misrepresentations in regard to the Saginaw Valley has kept the farming interest, never too prone to prosper in a lumber country, far behind what it should be at this time. But with all this slow progress these facts have been fairly and firmly proven, that the soil throughout all this range of country drained by the Saginaw river and its tributaries is, as a rule, excellent for farming purposes. And among some of the pine tracts, as is the case on the Cass, the Flint, the Tittabawassee, Chippewa and other streams, is found some of the most productive lands in the State.

As lands are cleared and opened to the light and heat of the sun they improve every year, and in the broader clearings untimely frosts are so marked an exception to the general rule that there is no further fear of that dread bugbear. As one proof of this I remember, as some of you will, the then few scattering people of Gratiot county appealed to the people of the State for aid —I think in 1859. They claimed that the frosts of the fall before had destroyed their crops to such an extent that they had nothing but browse to feed their cattle, and that they were in destitute circumstances. You gentlemen have just held an institute at Alma in that county. Would you, from what you saw, believe this? It is to-day a veritable garden, the peer of any county in the State, with rich farmers able and willing to respond to like calls should they come.

In conclusion, I ask your indulgence in any shortcomings as your chairman, and again we welcome you to our midst, and trust the hospitality and courtesy of our people will make your stay pleasant and that the time spent will be profitable to all.

Most of the discussions of the Institute will be found in connection with the papers which called them out.

The incidental discussion on potatoes and potato rot is united with that following the article on the same subject by Mr. Crozier.

Mr. Lewis' article on "Gumption" gave a good deal of amusement. Among other good things, he said that a barrel of slaked lime was one of those things which no farmer should be without; that it was just the thing with which to begin operations in the spring, sprinkling the cellar, whitewashing the fences, chicken house, cow stable, etc., dosing various insects, and washing the fruit trees. By all means, keep a barrel of slacked lime always on tap.

Hon. Wm. L. Webber, in a paper on the Dairy Interests of the Saginaw Valley, showed that this Valley constituted about one-fifth of the Lower Peninsula of Michigan, or 8,000 square miles, and maintained that for agricultural purposes there were no better 500,000 acres in any State in the Union. About one-tenth of this region was within the limits of Saginaw county. Of this half million acres, one hundred thousand could be spared from crops and timber for pasturage. On this, 25,000 cows could be kept, and at a low average, they would produce 4,000 pounds of milk apiece per year, or a total, at one cent a pound, or two cents a quart, of $1,000,000 worth of milk per year that ought to be produced in Saginaw county.

Mr. Webber spoke of the desirableness of an increase in the number of cheese factories, and described the centrifugal method of separation of cream from new milk by means of cylinders revolved by machinery, which makes it possible to feed the skim milk to the calves before it has lost the animal heat.

Milk consists chiefly of casein in the skim milk and fat in the cream. Casein is the flesh-forming substance, the fat being chiefly useful in keeping the animal warm, so that by use of warm stables, if the milk is not skimmed too closely, calves can be raised as well in this way as on milk with all its cream.

Mr. Graham: Which is the best crop for feeding cattle, barley or corn?

Mr. Youmans: Corn makes the most and the richest milk, as it has more sugar than barley has.

Mr. Graham: I find barley cheaper to raise than corn.

Mr. Geddes: Barley is a cheap crop to grow, and draws but little on the soil. The hulless variety is the best.

Mr. Beeman: I always soak barley for feeding, and consider nothing so cheap or so good. Have raised it for several years, and get from 40 to 47½ bushels per acre.

GRASS LAKE INSTITUTE.

PROGRAM.

MONDAY EVENING, FEB. 15.—7 P. M.

Music.
Prayer, by Rev. John Patchin.
Welcome Address, by Rev. J. M. Kerridge.
Music.
Peaches for Profit—Prof. W. H. Merritt, Grass Lake.
The Needs of Agriculture—Prof. Samuel Johnson, of Agricultural College.
Music.

TUESDAY MORNING, FEB. 16, 10:00 A. M.

Music.
Farming on Light Soils—C. L. Hall, Norvell.
Essay—Miss Mary Hitchcock, Sharon.
Music.
Style in Farming—Prof. L. H. Bailey, Agricultural College.
Music.

AFTERNOON SESSION—2 P. M.

Music.
How does the soil lose its fertility?—H. A. Ladd, Brooklyn.
The Agriculturist—Martin Haynes Grass Lake.
Music.
Suggestions relative to Farm Economy—Hon. William Ball, Hamburg.
Music.

EVENING SESSION—7 P. M.

Music.
The Agricultural College—Lewis Palmer, Napoleon.
Music.
Robert Burns as Peasant and Poet—Prof. E. J. MacEwan, Agricultural College.

Agricultural College Views by a Stereopticon, by Prof. F. S. Kedzie, Agricultural College.
Music.
President Willits and Secretary H. G. Reynolds were present.

Of this Institute the Grass Lake *News* said: "The Farmers' Institute in this place, which held its first session Monday evening, and wound up Tuesday evening, can be denominated a success in every particular, and has no doubt been fruitful of much in the way of information on agriculture. Grass Lake is pretty well advanced when it comes to agriculture, as it contains some of the most successful farmers in the State, and for this reason they are not slow to take hold of a good thing when it comes along, and make it a success. In respect to the Institute, they were more than successful. The ladies, too, were largely represented, and contributed their presence at all the meetings. The hall was crowded at all the meetings, and the interest increased to the last. On Tuesday night many were turned away on account of the crowded house, even all available standing room being taken up. The papers and addresses of Prof. Merritt, L. L. Hall, Mrs. Mary Hitchcock, H. A. Ladd, Martin Haynes, Wm. Ball, Lewis Palmer, were each and all good, practical and entertaining. An enjoyable feature of the meetings was the excellent music with which they were interspersed. Altogether, the Institute was an interesting one, and it is believed resulted in much good from the practical discussions indulged in, and the mutual interchange of opinions and ideas."

Such of the papers as were entrusted to the Secretary will be found by reference to the index.

QUINCY INSTITUTE.

PROGRAM.

WEDNESDAY, FEBRUARY 17, 7 P. M., 1886.

Meeting called to order by Hon. C. G. Luce.
Music.
Prayer by the Rev. L. Grosenbaugh.
Introduction of H. D. Pessell, President, with Address of Welcome.
Response by Hon. C. G. Luce.
The Agricultural Geology of Michigan—Prof. A. J. Cook.
Music.
Essay—Mrs. E. W. Treat.
Plea for Pure Literature—L. Bowen.
Music and Dismissal.

THURSDAY, FEBRUARY 18, 9 A. M., 1886.

Music.
Prayer by Rev. E. B. Moody.
Future of Agriculture in America—G. W. Fisk.
Music.
Essay—Mrs. Nixon.
Social rank of Farmers—Hon. M. D. Campbell.
Agricultural Fairs—J. W. D. Fisk.
Style in Agriculture—Prof. L. H. Bailey, Jr.
Adjourn for Dinner.

THURSDAY, 2 P. M., FEBRUARY 18, 1886.

Music.
The value of the thoroughbred in improving our common stock—L. M. Marsh.
Recitation—Miss Grace Lytle.
Capital and Labor—Relations of the Farmer to Both—Hon. C. V. R. Pond.
Music.
Essay—Mrs. H. M. Traverse.
Four Important Insecticides—Prof. A. J. Cook.
Poetry of the Farm—Mrs. H. C. Bailey.
Music.
Adjourn for supper.

THURSDAY, 7 P. M., FEBRUARY 18, 1886.

Discussion on Insecticides.
Essay—Mrs. H. W. Noble.
Music.
Robert Burns—Prof. E. J. MacEwan.
Music—"Home Sweet Home."

The Town Hall had been very tastefully decorated with the national colors, evergreens, flowers, and a fine display of fruit in preparation for the Institute, and its meetings were all crowded.

President H. D. Pessell welcomed those in attendance in an address, from which I quote:

Ladies and Gentlemen:

Ideas, like electric sparks, are evolved by friction. We need to come in contact with each other in order to be sharpened and polished.

By meeting together in these Institutes we listen to the experiences of each other, and to the voice of science as it recounts its triumphs from year to year.

"Knowledge is power." When mind meets mind, and there is an interchange of ideas, then will intelligence increase in a noticeable degree. There are a few who will not step outside of the old beaten tracks of their predecessors, but will still hold fast to the superstitious notion of "planting their beans in the moon." This class of farmers will generally be found opposing all innovations or progressive ideas, in whatever form they may be presented. He who dares to go beyond the beaten track will march on to enterprise and improvement. The men who do not meet and associate with their fellows are little else than hermits. Let two farmers meet and converse upon the subject of husbandry, exchanging views and experiences, who will deny but that something can be learned, of great advantage to them both. How much more then can an Institute, composed of practical and scientific farmers, illustrate the ideas thus briefly set forth. These Institutes are a recognition of the fact that success in farming does not wholly depend upon unremitting labor, but like success in every pursuit in life, upon work guided by intelligence. The history of the world, from its earliest ages down to the present time, shows that man has been a student, slowly but steadily making advancement in a knowledge of the laws which govern matter. In the great march of time and progress, has the husbandman kept abreast with men of other vocations in social and intellectual improvements? This calling has not attained that commanding position in the affairs of State and nation which its importance deserves. But the opportunities for the farmers of to-day are far in advance of those of any former period. The press, farmers' clubs, and the Grange, with its perfect organization and immense influence are bringing to the knowledge of our legislators, both State and National, the wants of the agriculturists of America. That they are making their influences felt in our legislative halls, is evidenced by the introduction of a bill establishing a Bureau of Agriculture, making the head thereof a Cabinet officer.

The speaker then gave a short account of the early history of Branch county, and closed with a repeated welcome to the visitors.

President Willits replied in a short talk, the substance of which is included in the paper under his name.

The sessions were distinguished by particularly enjoyable music, and by a number of fine papers from ladies, one by Mrs. E. W. Treat on the "Possibility of Ladyhood for a Farmer's Wife" being especially valuable.

The Institute closed with cordial votes of thanks to all those who had contributed to its success; and thus ended the series for the winter.

LECTURES AND ESSAYS READ AT FARMERS' INSTITUTES.

THE POETRY OF THE FARM.

BY MRS. H. C. BAILEY, OF COLDWATER.

[Read at the Quincy Institute, February 18, 1886.]

I saw at morn a grand old wood
Which had for generations stood;
It held aloft its giant hands
And sheltered well the pleasant lands.
'Twas springtime; all around was seen
That tender tint of living green
Which promise gives of loveliness
When nature dons her summer dress.
The winter snows had scarcely yet
Uncovered the blue violet,
But in the little sunny dell
It strove to break the potent spell.
The stream from icy fetters free,
O'er pebbles danced right merrily;
And 'long the banks the willow hung
And sang of spring with silver tongue,
While many a bird with anxious breast
Sought where to build its cosy nest.
High over all the sky was blue
As when creation's song was new.

Hark! Thro' and thro' this grand old wood,
Awake, yet full of solitude,
There rang the sound of woodman's steel
Till e'en the forest seemed to feel
A sadness, as each measured stroke
Upon the solemn stillness broke.
From slenderest twig to mighty oak
A tie of brotherhood there ran—
'Twas severed by the hand of man.

Time passed—but with each coming day
That wood was passing, too, away.
A little clearing had been made
Ere yet the trees threw down their shade
Upon a tiny cot that stood
Just nestling up beside the wood.
Ere summer came the woodman brought
A bride to share his humble lot;
And never bird in tree or sky
Whose joyous song could with her vie.
In city walls she long had dwelt,
But now a sense of freedom felt;
To Nature's psalm she joined her voice
And sang from morn till night rejoice.

The clearing grew; a little spot
Was planted late, but throve—Why not?
The dark, rich loam was fertile field
And surely would a harvest yield.
The wife beside the cottage door
Sowed seeds of which she had a store,
That soon, green springing from the earth,
Were lovely only at their birth,
And later, e'en an artist's eye
Were 'raptured with their changeful dye;
While clambering vines beside the door
Yield shade and blossoms evermore.
Fair cousins these of those wild flowers
Which graced adjacent sylvan bowers—
Seed sown by Nature's hand—not ours.

Thrice welcome now the gentle rain
That patters on the window pane,
And as the crystal drops come down
The thirsty earth so dry and brown,
Seems, as it drinks from well-filled cup,
To offer a thanksgiving up.
Anon the vivid lightnings flash,
And awful thunders o'er them crash:
But safe within each other's arms
They fear not Nature's wild alarms;
They know that he who sends the storm
Will sure his promises perform;
With child-like faith they wait to gain
The early and the latter rain.
Rich largess shall to them be given,
For faith and works are blest of heaven.

All through the warm, soft summer days
They watched the ranks of growing maize
Whose long green leaves and tassels brown
Seem fit to wreathe in Ceres' crown.
Ere yet the autumn leaves appear
The corn is full within the ear;
And richer yet between the rows
The luscious golden pumpkin grows.
Some vegetables stand apart,
In size to cheer a gardener's heart;
While mother earth aneath her breast
Hides stores to challenge all the rest.
When autumn spreads her carpet down
In richest gold and red and brown,
She brings of nuts an ample store
And leaves them at the cabin door.

So, like the squirrel and the bee—
Their neighbors—they industriously
From Nature's granary gather store
Till winter comes and shuts the door.
The air is chill—the white snow lies
Around the cot and fills the skies;
But busy cares, indoors and out,
Put lonely thoughts to sudden rout.
The evenings long by cheerful fire
Bring thoughts which might the muse inspire.
The inviting page is duly scanned,
While in the thrifty housewife's hand
The shining needle swiftly flies;
She, listening as her task she plies.
When comes the thought of other days,
And friends, once wont to blame or praise,
From full heart swells the rising tear
But all of *home* is centred *here*.

Soon plans for spring the hours employ
And lengthened days bring brighter joy.
Anon the sun with loving beams
The maple's juices starts in streams;
Long ere the cowslip opes her cup
Rich store of sweets is treasured up.
And when the balmy breath of May
Unfold new beauties day by day,
Within that little cot so blest,
Upon the pale young mother's breast,
A tiny babe in sweet surprise
Has opened its blue violet eyes.
Ah! bud of promise, pure and fair,
No flowret can with thee compare,
For love in all thy ways shall find
Th' unfolding of immortal mind.

Now come new neighbors settling near;
Their cabins build and forest clear,
And all around the air rings out
With sound of laborers' jocund shout.
The town seems not so distant now—
Just past yon emerald hillock's brow—
And on the sweet still Sabbath morn—
While yet the dew empearls the thorn—
The church bells' chime comes faint but clear
To greet the waiting, list'ning ear.
Years pass away, that little cot
Embowered in that shady spot,
Stands there no more—its place supplied
By one of elegance and pride.

Broad lands, full barns, flocks far and wide,
Bespeak prosperity's full tide;
The farmer counts his labors o'er,
For blest is he in heart and store.
Inside that home, the mother yet
Holds gentle sway, though round her, set
Like jewels round a central stone,
Are sons and daughters; every one
Has breadth of culture, purpose high,
Nor deem that they from home must fly
To find, in city's busy mart,
Of life, the truer better part.
Of course in time some wander far,
But *home* is still their guiding star;
Each year they tread its sacred sod
And look from it to Nature's God.

Kind Friends, we close—though just begun—
Our tale, though long, is but half done.
Let him who sees in field and sky,
And farm life, no sweet poetry,
Go dwell in crowded city street—
Stranger to all whom he may meet—
Hemmed in to see no sunrise fair,
No golden clouds in evening air,
No bow of promise, feel no breeze,
Soft sighing through the leafy trees,
No whispers weird 'tween vale and hill,
No wild brook babbling to old mill,
No voice of Nature low and sweet,
No emerald turf beneath his feet.
Thus let him live in pomp and pride;
But give to me the country wide;
And when I die, oh, let me sleep
Where mother Nature, watch will keep;
Where birds will sing and wild flowers wave
Above my low, turf-covered grave.

LEGAL ADVICE TO FARMERS.

BY JUDGE W. S. TENNANT.

[An address before the East Saginaw Farmers' Institute.]

Many of you have doubtless seen copies of the work entitled "Every Man his Own Lawyer," which pretends to give all legal information required for the inexperienced, as well as all legal forms for use in business. These and like books may be useful in their way, but experience teaches that it is better for the farmer in cases of difficulty or doubt in business matters to take the advice of some good lawyer, who may by proper advice save him the expense of litigation. For example, witness the records of our courts in suits brought to recover upon the promissory notes of farmers who have been swindled into signing their names to papers which they deemed harmless at the time, but which proved to be a fraud perpetrated upon them by experienced swindlers. Buy no "patent rights" or interest in patents for farming implements without advice from your lawyer. Always keep in mind the old maxim, "An ounce of prevention is worth a pound of cure."

As to when you should go to law, perhaps the best advice I can give you is that given by Jerrold to those about to marry, "Don't!"

I say, don't go to law if you can help it, but if you are forced into law to protect your legal rights, then get the best lawyer you can find and leave the case entirely in his hands. But a lawyer will often advise you to keep out of litigation, for it is the business of a good lawyer to prevent lawsuits by advising some fair or honorable way of settlement of the matters in dispute.

It is a maxim of time-honored antiquity that "He who is his own lawyer hath a fool for a client." And so I advise you, farmers, in all important business matters consult your lawyer, for the $5 paid for legal advice may save you the loss of a thousand in property, or the expenses of a protracted lawsuit.

A certain smattering of law every man engaged in business soon acquires, for law as well defined is but "the application of the best business principles to business."

Common sense is the foundation of the common law. That is, it is what the experience of 300 years and more among intelligent men has proved to be the wisest laws and rules for the government of humanity. To this extent custom makes the law. We have in this State what is known as the common law, which Coke in his quaint language defines as "that which hath been the custom, time whereof the memory of man runneth not to the contrary."

It is "custom crystalized into law." In other words it is those rules of conduct which by the unanimous consent of mankind are given the force of law without the formality of legislative enactment. We are also governed in this State by our constitutions and statutes, State and Federal.

In our republican form of government we have three distinct departments, each of them separate and having nothing to do with the other, viz: the Executive, the Legislative and the Judicial. The Legislative department is the sovereign power of this country. In creating the Legislative Department and conferring upon it the power to make the laws, the people have conferred upon it full and complete power to make laws at its discretion, subject only to such restrictions and limitations as are imposed by the constitution of the State or of the United States. Every subject within the scope of Civil Government is liable to be dealt with by the Legislature. Our State constitution establishes the division of the State into counties, townships, cities and villages, all of which have, to a limited extent, legislative power

I will direct your attention to some of the powers conferred upon you to act, within your respective townships or counties, in legislation for your farming interest. For instance, the law for the use of public highways, and the rights of adjacent land owners. By the general law all animals are forbidden to run at large in any public highway, but certain legislative powers are conferred upon the Board of Supervisors of each county, giving them the right to legislate upon this point within the jurisdiction of their respective counties.

Act No. 185 of the Laws of 1867 is entitled, "To prevent animals from running at large in the public highways."

Section 1 contains a full and absolute prohibition, extending to all the animals named therein, "Cattle, horses, sheep or swine," from running at large in the public highway, but this is restricted by the proviso, that the Board of Supervisors may, by resolution, render the act inoperative as to the whole or part of the county.

The Supreme Court, in Cook vs. Bassett, 23 Michigan, 117, says: "Section 2 contemplates that the Board of Supervisors may see fit to allow a larger range to some of the animals named therein than to some of the others, and this construction is required to make it sensible.

In Campau vs. Konan, 39 Michigan, 365, the Court says: "The owner of lands adjoining the highway is entitled to the herbage growing thereon, and whatever rights the public may have in the highway, a 'common or pasturage,' is not among them."

"The inhabitants of each township may, at any legal meeting, by a vote of qualified electors thereof, make all such orders and by-laws for determining the time and manner in which cattle, horses, sheep and other animals shall be restrained from going at large in the highways." Section 673, Howell's Annotated Statutes.

This law has a restrictive force. It does not abrogate the common law liability of owners of cattle for trespassing upon the land of others. Its provisions do not by any implication authorize such animals to run at large thereon at any time. The Board of Supervisors alone have power to suspend the general law forbidding the running at large of animals in any public highway of this State.

There are many laws specially designed to protect the interest of farmers, but to speak of them in detail would weary your patience. But I desire to call your attention to another subject of a legal nature of great interest to farmers, as well as other business men. The transportation of farm products by railroads, as affecting the interests of the farmers.

THE RAILROAD QUESTION.

We have most ample and excellent water communication, by way of the great lakes, that enables us to ship our products at less expense to the markets of the world. We are in the center of the great railroad system lying between the east and the west, and we ought to have cheaper transportation for the products of our farms to the eastern markets.

There is just cause for the complaint that railroad corporations absorb the bulk of the profits of the farm. The people who make the Legislature have the power to fix the compensation of railroads for the transportation of your farm products to the markets of the world; you, the farmers of this country, are all powerful if you did but know your strength. The total vote of the United States in 1880 was less than 10,000,000. The number of farmers in the United States are nearly five millions. You are in the majority, and if you unite you can make and unmake the lawmakers. Now, the commerce between the several States can only be regulated by Congress. The Legislatures of the several States have no power outside of their jurisdictions as a State. The laws of this State may fix the rates of freight and the rates of passage on all railroads within the State, but no further. But Congress can fix the rates of freight over all the railroads in the Union. You make Congressmen, and they make the laws respecting railroads. The railroads are owned and controlled by corporations created by the statute. The power to create corporations is conferred by the people upon Congress and the Legislature. The power to prevent unjust discrimination in freights between different points, and to establish the rates of freight for the transportation of your grain and other products is with the farmers of this Nation. A fair share of the profits of your farm should be shared by the capitalists, who have built and now own and control these railroads, which form the connecting link between the east and west. They have aided the people in opening up this great western country, and making this country the greatest producer of the cereals of any nation on earth, and capital should have its just proportion of the profits. Let us see what share they have taken. Within the last twenty years the railroad corporations that built the railroads connecting the east and the west have been absorbed and consolidated, the weaker being swallowed up by the stronger, until all the leading lines are now held and controlled by a few men. Such fortunes, as were never before known to have been made in one generation, have been accumulated by men like Gould and Vanderbilt, in the manipulation of railroad stocks. It is not for the interest of the future of this Nation that a fortune of three hundred millions is accumulated by a father and son in one generation; neither is it in the interest of the people that our entire system of railroads should be owned and controlled by one man. It is not in the interest of farmers that these men should have absolute and unlimited control of the railroads, and thereby be able, as they now are, to fix the price of your wheat and other farm products. The farms of the great west have a right to demand cheap transportation to the seaports of the Atlantic. If the farmers unite in this demand they will be heeded. You hold the ballot; you can elect those men to represent you who will work in your interest. In this age and under our present system of Government, all evils can be corrected by the ballot. The future of this country is in the hands of the farmers. In the struggle between labor and capital the farmers of this country are the arbitrators. They will see that safeguards are thrown around to protect labor from any injustice or oppression, and in like manner they will guard instinctively all rights of property, both real and personal. They will see that every man shall be permitted to use and control what he has honestly acquired by the use of his capital, or by his own mental or physical labor Coöperation between capital and labor, by which each shall get its fair proportion of the profits, is just aud right. The conflict between labor and capital, resulting in public riots and labor strikes, in the manufacturing cities in this country, is a matter of great regret and anxiety to all thinking men. There is an element in our society, not native born, but brought from the oppressed classes of Europe, that seeks to overthrow our free institutions and abolish all rights in property. These socialists and communists conduct a warfare against society in all its forms. They would take away all rights in property. They would destroy the family relation. They would abolish the laws of inheritance of property. They would, in fact, make earth a chaos. They may at times control for a brief period in our large cities, and property and life may be jeopardized, but the stability and permanence of our Government is made secure by the farmers and the honest laboring men, who believe that ownership in property should be protected. The future of our country is safe while the farmers are in the majority. The poor laboring man, who finds life burdensome in the competition of labor within the crowded cities, can, by saving his earnings for a few years, in working in the mills or factories, accumulate sufficient to buy forty acres in our western country, and this in time will make a comfortable home for himself and family. The overcrowded cities must be relieved by prevailing upon these laboring men, who, by competition, have depressed wages, to go upon our new lands and improve them. This alone will make our country prosperous and happy. Of all classes, none are more independent, comfortable and happy, than the farmers of our country.

Finally, I advise you all, as farmers of Michigan, give support to the common schools, to the Normal schools, and to our State University; and last, but not least, send your boys to our State Agricultural College, that the next generation may become educated and intelligent farmers. In conclusion, bear in mind the scripture injunction : "Let each man first take care of his own household."

CAPITAL AND LABOR—THE FARMER'S RELATION TO BOTH.

BY HON. C. V. R. POND, STATE COMMISSIONER OF LABOR.

[Read before the Farmers' Institute at Quincy, Feb. 18, 1886,]

Mr. President, Ladies and Gentlemen of the Farmers' Institute:

When invited by your local committee to prepare a paper for this occasion, I was asked if the subject might not be, "The Labor Bureau, and the Farmer's Relation Thereto?" To this inquiry the reply was given that the relation of the farmer to the Bureau was identical with that of all citizens of the State, and for me to use argument to prove the value of the Bureau before this Institute might give strength to the thought that officially I feared sufficient importance was not attached to this department of work, now authorized by statute law. I preferred that so far as my connection with the Bureau of Labor is concerned, the annual report, soon to be given to the public, should, after a careful perusal, be accepted as evidence for or against the usefulness of an office, which has for its work the gathering of statistics bearing upon a subject which is to-day engrossing the attention of national legislative bodies.

The subject then, accepted by your committee and myself for a brief talk to you this afternoon is, "Capital and Labor, the Farmer's Relation to Both." In a talk upon this subject in the short time allowed by the program, let me ask you to keep in mind the fact that for ages capital and labor has been a topic of discussion by the press and by the people, but that until within the last decade it has occupied no nationally familiar place in the United States. To-day, standing in boldest type, the two great words form the "headlines" of some column in every day's issue of many of the papers of our country, while a number of journals devote their entire space to articles upon the subject of either capital or labor. The political parties of our land incorporate in their several platforms some one or more "planks" that bear expressly upon the subject, the purpose of which is explained by much oratorical ability as being the displacement of capital and the advancement of labor, hoping thereby that the votes of labor will go to the orator's party. The citizen, whose head-gear is a hive in which "political bees" are often buzzing finds the subject one upon which he delights to discourse, and the wage-worker of to-day is filled with surprise as he listens to the speech of men who are willing to be sacrificed upon the altar of office only that they may be his public benefactor, and frame laws that shall elevate him beyond the "tyranny of capital." The learned teacher of education, the clergy, the student, the writer upon political economy, men of greatest mind, write and talk upon the subject, and with all of the discussion a conclusion has not yet been reached that shall so assimilate capital and labor as to make an obsolete quantity of that which is to-day rippling the waters on the sea of danger.

Yet no one can deny that through the discussion by the press and by the people, save where selfish political motives actuate the author, we are coming nearer to an intelligent knowledge of the causes of the differences between employer and employé.

In our talk this afternoon no thought is entertained that a great social and political problem will be solved, but if the presenting of thoughts, with a few facts and figures gained in an official way during the year just closed, shall enable any member of this Institute to feel that they have been beneficially informed, then the time consumed will not have been idly taken from you.

First, let us look into the relations of capital and labor.

Capital may be money, merchandise, lands, or any kind of property, in treating of it in opposition to labor, but in reality it is the accumulated product of labor and the profits of the savings of labor. It is the ally of labor, without the help of one to the other neither can continue in existence.

Labor, as spoken of in this talk, is that which is given by A to B for a compensation, called wages. B receives from A for a stipulated price that work of the hands which adds to the property accumulation of B. That accumulation is capital. B pays to A money for his labor; is this capital? If the amount paid by B to A is in excess of the amount needed by A to pay all expenses contingent upon his living, that is the supporting of self and dependents in a manner which he has a right to desire, if we say there is an excess over consumption, and that excess is saved, then it is capital. If the labor of A which he gives to B does not receive in return a compensation equal to his needful living demands, then we submit that capital has oppressed labor. If A does not receive a profit for his labor, and his labor creates a profit for B, then we submit that capital has wronged labor.

The oppression and the wronging of labor as just referred to is based upon the proposition that both A and B are striving to the same end—accumulation of property. Both are denying themselves extravagant or non-essential habits in the desire to accumulate savings. B has an advantage which he secured by previous savings and denials; he has saved a property, he is now an employer, A is his employé. If B, in securing the assistance of labor, which he must do in order to add to his accumulations, seeks to take advantage of an over-supply of labor by reducing its value in wages, then we submit that he oppresses labor

Labor, under the general laws of man's usefulness and willingness in working, will produce as much capital for its employer, at $1.00 per day, as at $1.50 per day's wages. We say under the general rule of man's power and ability to work, this is so. In the one instance, labor is the slave; in the other, it is enjoying full liberty. A slave, it is true, will not readily put his will power into working connection with his muscle, while the freeman throws every faculty into harmonious action. Now if the proposition is correct, that capital may be benefited as much by employing labor at $1.00 per day as by paying $1.50 per day for the same work, then we submit that capital has not only wronged labor, but has stolen from labor one-third of—what? labor's capital? No! For labor being oppressed has not lived—it has only existed, and capital is labor's surplus Capital has stolen from labor and added to itself one-third of labor's living and surplus combined, the surplus being a minimum portion of the theft. Is the proposition correct? Let us look into the matter, not with a desire simply to prove an assertion, or for the sake of advancing a theory, but to ascertain if it be possible that capital does or can thus wrong labor. To illustrate we will take a community of 1,500 population, surrounded by a population of 3,000 living upon farms. In the community there are fifty male persons between the ages of sixteen and sixty years who earn their living as wage-workers, but are now out of employment. Some are carpenters, painters or masons, some are called day-laborers, but not all of the mechanics are properly known as skilled workmen. These men came to this community at different periods, work had been plenty, and savings had been formulated into homes.

In the history of this community its growth rested, buildings ceased to be erected, and the fifty wage-earners spoken of find no work in their usual vocations. They have become surplus labor. Idleness being an unsought quantity, they ask for work of any character. As mechanics, with work, they could earn $2.00 or $2.50 per day. At work with which they are unacquainted, they recognize the necessity of an acceptance of less wages, and yet at unskilled labor they are equal to any. In the community there starts a manufacturing industry. In other communities a similar industry is paying upon a basis of ten hours for a day's work $1.50 per day for labor. This establishment wants thirty men; there are fifty idle. So anxious is labor for employment that $1.00 per day being offered, is quickly accepted, and work is commenced. The product of this industry goes upon the market, and is sold at the same price that similar products are selling at, though in once instance labor costs one-third less than in others. Capital has taken advantage of a surplus labor and added to its accumulation at the expense of labor. The twenty men who failed to secure work in the community go to the agricultural districts and seek work. Their labor is wanted, but being competitors they are offered and accept wages below the prevailing rates, because the farmer sees that necessity has compelled them to enter a new field and take what may be offered. Does the farmer make a reduction from the ruling market price of his farm productions because his working pay-roll has been thus decreased? Not at all. Capital has again taken the advantage of labor and added to its accumulation at the expense of labor.

But, it is said, supply and demand regulate the price. Certainly this is true in the laws that govern production and consumption. It is also true that cheap labor will make cheap goods. In the illustration just noticed the price of labor did not effect the price of products, but it did, and naturally must have, its effect upon the future price of labor, and when wages are generally reduced, then other causes than competition will reduce the price of products. Cheap labor is obliged to curtail all its expenses. The product of the farm or factory must lose its labor patron if that patron is not given a remunerative wage for his share in producing that product. Labor drops from the list of consumers when you deny it a purchasing power. This power comes only from a proper remuneration for work performed. High wages must of necessity increase the *cost* and thereby the *price* of production. Does this mean that increased wages, increasing the price of productions will benefit both capital and labor? We think it does. Capital, by increasing wages, increases a demand for its productions. The per cent of expense added to the *cost* of production by an increase of wages is very much less than the per cent. of increase of labor's power to purchase, while the increase of demand causes also an increase in the employment of labor and further power of purchase.

Then capital, having to supply a demand at fair prices, is accumulating, and labor, with fair wages, is having a life with its rightful share of blessings, and is also accumulating. At this stage capital and labor assimilate and both are prosperous. As the first drops out of active life labor takes it place, for by accumulation of savings over consumption, it has become capital. This capital is not necessarily in money form; it may be in merchandise, or machinery, or acres of land. We said that to take advantage of an over-supply of labor by the reduction of wages was to oppress labor. If you have in your minds the question as to how we would treat labor when the supply is greater than the demand, if not by a reduction of its cost, we answer, it should not be treated as a commodity that can be dispensed with, but as an essential, which alone can place a commodity in the market.

Before closing this talk it may be our privilege to give some figures showing what creates surplus labor, but at present we remark, if capital will refuse to be influenced by the surplus quantity and pay labor the highest wage consistent with the transaction of a profitable business, then both will be benefited. Depression in busines may arise from various causes. Time will not permit entering into a discussion of those causes. In the overcoming of the difficulties superinduced by depression of business, let the retrenchment of the expense account cover every other point before labor is encroached upon. When such action influences capital then labor can not complain of oppression. The poet, Lowell, says:

> "The moral question's ollus plain enough—
> It's jes' the human natur' side that's tough';
> Wut's best to think mayn't puzzle me nor you,—
> The pinch comes in decidin' wut to *du.*"

Suppose now that when the "pinch" comes we apply the Golden Rule, have we not a remedy? By doing unto or treating with others as we would that they should do unto or treat with us, can we not dissolve the "tough" side of nature and remove all oppression either real or imaginary?

We come now to the second part of our subject—the relation of the farmer to both capitol and labor. We will confine ourselves in this talk to our own State except when speaking of imigration to the United States or giving brief accounts of farm work in other foreign countries.

First. The relation of the farmer to capital. What is it? We answer, ownership! The farm is capital; the farmer possesses capital; therefore, if Webster rightly defines the word, the farmer is a capitalist. I am aware that I am speaking to a greater number of farmers, either active or retired, than any class of business men. You possibly feel an inclination to repel the assertion that you are a capitalist. You should not. It is in no sense a dishonor, unless you have built yourself intentionally upon the wreck of others. It is an honor to have capital, won in an honest life struggle. We do not make the assertion that a farmer is a capitalist as a mere theoretical expression, but for the purpose of drawing your attention to a few *facts*, which in the study of the question now before us, you may have lost sight of. If a man have capital he is surely a capitalist. If not, what is he, when referring to his capital? It has already been said that capital might be money, stock, merchandise, or land. Then if a man own either a quarter or full section of land, he has capital to the full extent of his ownership. A man has worked as a farm hand for many years. By prudence and strict economy he has saved $500 ; it is his capital; he seeks an investment; he places the amount at interest, his security is still his capital. Suppose that he buys eighty acres of land at $50 per acre—a fair value. He pays his $500 upon the place and gives back a mortgage of $3,500, he still has his capital and has borrowed other capital, which he proposes, by means of its use, to make his own. The party of whom he purchased has the same amount of capital in cash and mortgage as when he held the title to his eighty acre farm. Both have capital, call the men what you may. The man with the least amount has the intention to own as much as the one of whom he purchased, and unless dreamily sleeping when some Bohemian oat swindler crosses his threshold will probably see his intention verified. Then if the owner of $500 worth of land has capital, surely the owner of 160 acres has capital, and and is he not a capitalist? A party invests $10,000 in mortgages, or in interest bearing stocks, that the profits on his investment may support himself and family, and if possible add to his accumulations. You call him a capitalist. Ten men invest $10,000 each in a manufacturing interest, and you say that capitalists have thus engaged in business. Ten men have $10,000 each in farms, and the necessary stock and implements—are they not just as surely capitalists as though they sell those farms and invest that money in mortgages, stocks or manufacturing interests? A capitalist and a monopolist are not necessarily the same person. The monopolist must have capital to create his monopoly, but less of capital is invested in monopolies than otherwise. It is a very general and oftentimes favorite subject for conversation, the "oppressions of monopoly" and "tyranny of capital," and while there may be much of reason for harsh criticism upon monopolies, nearly all the discussions are led by those who have capital. Has it occurred to the farmer who invested in the Bohemian oat swindle that he showed a desire to become a monopolist? He knew that only a few could afford to invest upon any large scale, and that oats at $10 per bushel paid an enormous per cent upon the use of land, the toil and capital invested, and he knew that but few could buy oats at $10 per bushel and feed to ordinary breeds of animals. He invested to help himself to a quick increase of capital at the expense of others. He became a monopolist in sentiment and would have been in reality but that his desire had led him into the trap of a swindle. Let us look within ourselves when feeling a desire to arraign any question at the bar of prejudiced opinion and see whether in throwing the stone of thought we may not break a window in own domicile. Now if farmers are capitalists, to what extent have they capital invested as compared with other industries—say manufacturers? We confine ourselves to Michigan. In the farm statistics of 1884-5, as collected by the Secretary of State's office, we find these figures:

Number of farms in the State	135,107
Number of acres improved	7,280,775
Number of acres unimproved	4,926,443
Total number of acres	12,207,218

For the value of these farms, that is the capital they represent, I am obliged to take the result of the United States census of 1880, as the footings of the State census of 1884, have not been completed so far as to show exact value. That the capital in farm lands in '84 was greater than in '80 is a fair conclusion, therefore the figures given are no exaggeration.

Total value of farms, including fences and buildings	$499,103,181
Total value of implements and machinery	19,419,360
Total value of live stock	55,720,113
	$574,242,654
Estimated value of all farm productions for 1879, consumed, sold and on hand	$91,159,858

Amount paid for wages for farm labor not stated.

The same United States census says of manufactures:

Number of manufacturers in the State	8,873
Total capital invested	$92,930,959
Total value of productions	150,715,025
Amount paid for wages	25,3 3,682
Amount paid for material	92,900,269

To bring this comparison within the limit of a district with which most of you are best acquainted, let us look into the same authorities and see the showing for Branch county. In 1880 we find:

Number of farms in the county	3,670
Value of farms	$14,475,037
Value of implements and machinery	435,033
Value of live stock	1,502,253
Total value, or capital	$16,412,323
Estimated value of productions	2,470,840

Number of manufactures in county	126
Capital invested	$489,665
Total value of production	1,179,014
Value of material	644,156
Total wages paid	221,374

Thus, my friends, you have the capital of Branch county as invested in two leading industries in 1880. In one instance 3,670 farms, with a capital of $16,412,323, or an average of $4,472.02 to each farm. In the other instance, 126 manufacturies, with a capital of $489,665, or an average capital of $3,886.23 to each.

Let us look at the cost of raising the three principal grain crops of the farms of Branch county. The figures given are compiled in the Secretary of State's office, and are for the year 1885.

WHEAT.

Average yield per acre, bushels	24.70
Cost of grain per bushel	$0.552
Net cost of grain per acre	13.64
Value of grain per acre Jan. 1, 1886	21.00
Value of straw per acre	1.21
Profit per acre	8.57

OATS.

Average yield per acre, bushels	37.83
Cost of grain per bushel	$0.346
Net cost of grain per acre	13.10
Value of grain per acre Jan. 1, 1886	11.35
Value of straw per acre	.75
Loss per acre	1.00

CORN.

Average yield per acre, bushels of ears	67.
Cost of grain per bushel	$0.238
Net cost of grain per acre	15.92
Value of grain per acre Jan. 1, 1886	16.08
Value of stalks per acre	2.39
Profit per acre	2.55

In arriving at the foregoing results every item of expense has been counted, including cost of marketing, taxes, insurance and interest on the land at the rate of seven per cent. on a value of $58 per acre. The interest account is usually called the capitalists profit. On an acre of wheat, corn or oats it is carried in the items of cost of production in above figures, and amounts to $4.06, which if added to $8.57 profit per acre, of wheat, and deducted from $13.64, the "net cost per acre," would make the cost of the grain at the market to be $9.58, and the profits to be $12.63 per acre, or a fraction over 131 per cent. But it has not been my intention to specially refer to the profits of farming, rather more particularly to show the farmer's relation to capital. Farmers may have losses, but their's is the only industry that does not figure to a greater or less extent in the weekly published list of business failures.

Now, Mr. President, if I have not already wearied this people, let me call your attention to the relations of the farmer to labor.

In the forthcoming report of the Commissioner of Labor there will appear a chapter devoted to statistics as to farm labor, referring especially to wages paid. In order to secure these statistics I sent a request and blank form to 1,016 supervisors in 75 counties of the State, omitting cities and five counties having little or no agricultural industry. Reports were received from 613 supervisors in 70 counties. The failure of so many to make a return showed not only a lack of interest in the inquiries made but a lack of business knowledge, for each person was furnished with a postal card for return answer. Of the 613 reporting, fifteen towns reported "no farm labor." The request made was that from at least four farmers in each township answers should be secured as to wages paid regular farm hands, with and without board, wages paid to tenants, in addition to use of house, garden and cow, wages paid to harvest hands, with and without board, and the average number of months per year that farm labor was employed, all for the year 1885. To ascertain the number of men employed as wage-workers upon farms would have caused an expense that the appropriation of the Labor Bureau would not cover, and I am therefore unable to give you any idea of the aggregate number in that industry, while in nearly every other the report will show very fairly the number employed. It might be easy to estimate the number of farm laborers, but I prefer to give no estimates in any figures save those furnished by the United States census in the matter of value of productions of farms, believing that facts are best arrived at from information based on actual condition. Therefore, in order to show at least something of the relations between farmers and labor, let me give you the figures gathered from the 598 reports to the Labor Bureau already referred to, showing wages paid to farm labor in the State.

Average paid farm labor, with board, month	$17 07
Average paid farm labor, without board, month	28 24
Highest paid farm labor, with board, month	30 00
Lowest paid farm labor, with board, month	8 00
Highest paid farm labor, without board, month	50 00
Lowest paid farm labor, without board, month	17 00
Average paid tenants, with rent, cow and garden, month	21 45
Highest paid tenants, with rent, cow and garden, month	40 00
Lowest paid tenants, with rent, cow and garden, month	10 00
Average paid harvest hands, with board, day	1 50
Average paid harvest hands, without board, day	1 92
Highest paid harvest hands, with board, day	2 50
Lowest paid harvest hands, with board, day	1 00
Highest paid harvest hands, without board, day	3 00
Lowest paid harvest hands, without board, day	1 25

Average time regular labor is employed, 7 months 2 days.

Time will not permit my giving you in detail the wages of each county, or even Congressional District. The report referred to will give carefully prepared tables showing a complete anyalysis of the wages paid for farm labor as gathered from the several counties. Should any present desire to inquire as to the wages paid in any town or county, I will answer such questions at the close of this talk. The above figures show the average wage paid, with board, to be $17.07 for the State. The average by Congressional Districts is as follows:

First district	$15 82
Second district	16 68
Third district	16 85
Fourth district	16 63
Fifth district	15 94
Sixth district	16 49
Seventh district	15 28
Eighth district	16 20
Ninth district	16 78
Tenth district	18 59
Eleventh district	18 34

The first, tenth and eleventh districts, in 1880, raised 760,795 bushels of wheat and owned 30,309 sheep. The eight remaining districts raised 29,314,-170 bushels of wheat and owned 1,916,434 sheep. It is plainly shown where the bulk of the producing farms are located. To come nearer home, let me give you a few figures pertaining to this, the third, Congressional District, comprising the counties of Branch, Barry, Calhoun, Eaton and Jackson. In 1880 these counties produced the largest amount of wheat raised in any Congressional District in the State—5,570,356 bushels—and they owned 379,670 sheep. The average wage paid for farm labor in the district in 1885 was:

With board, per month	$16 85
Without board, per month	22 90
Highest with board, per month	22 00
Lowest with board, per month	8 00
Highest without board, per month	33 00
Lowest without board, per month	16 00
Tenants, average per month	20 97
Harvest, with board, per day	1 97
Harvest, without board, per day	2 35

Average months' work for 7 months—22 days.

That you may not feel that the figures given prove a payment that cannot be improved upon, let me say that for harvest hands, with board, of the towns in the district that was reported, there were five paying $1.50 per day; one paying $1.62 ; two paying $1.75 ; 49 paid $2.00, and one paid $2.50. Of those reporting wages without board, there were six paying $2.00; seven paying $2.25 ; one paying $2.38; twenty-one paying $2 50, and one paying $3.00 per day. In the entire State, as shown from reports from 585 towns, the average wages paid to harvest hands, with board, was, in

66 towns	$1 00 per day
84 towns	1 25 per day
194 towns	1 50 per day
53 towns	1 75 per day
185 towns	2 00 per day
3 towns	2 50 per day

Showing that more than one-fourth of the towns paid $1.25 per day or less; nearly three-fifths paid $1.50 per day or less ; while more than two-thirds paid $1.75 or less. Members of the Institute, you have been shown your relation to capital. With the figures already given, can you not see your way clear in your relation to labor, so far as wages are concerned ? Pay such wages that the employé who is given an opportunity to work but a portion of the year may have enough to support himself the balance of the year and make a saving for future use. Or, what would be better, give steady employment to labor. Do you deny the strength of such an assertion? Look at your home circle and tell me why the wife and daughters are obliged to toil so earnestly from morning until night, beyond the essential duties of the women of the home. Tell me why the sons desire to, and do leave, the farm, where the brightest of all business opportunities should be centered, and where, from childhood, they have studied and mastered a trade ; tell me why they rush to mercantile centres and seek employment in the store or counting room, driving those who were brought up in the towns to join the mighty throng of surplus labor? The principal and most direct answer should be, that yourself and wife are aged at 50 years, your sons and your daughters are disarmed of all love and respect for the farm, because of your desire to add to your capital at a more rapid rate than the laws of physical nature will permit. The days of pioneer life in Michigan are over. There is no demand for this distress you bring upon the physical body of yourself and family. With *more labor help*, your faculties unimpaired, having needed rest, your children educated, and the sons especially taught the mechanical knowledge which has been so wisely made an important feature of our Agricultural College and other institutions of learning, and your life is not only happy, but the soil is made to bear a richer increase, because of the life and vigor enjoyed by those who till it. By the employment of more labor you not only give yourselves a proper rest, but you are enabled to bring the hours of labor for your employes within a rational limit. I well understand that in the harvest season the daily hours of toil are generally considered as necessarily greater in number than in ordinary seasons. You make them greater than they should be. If two persons do a certain amount of work in fifteen hours each, three persons will do the same in ten hours each. And though you have paid the extra wage to the third person, you have placed the two persons in a physical condition to more than earn that extra wage back in the days that are before you. Your relation to labor is not that of the master to the slave ; you are generally on an equal footing, so far as the rights of citizenship enter into the ques ion of relation. Labor may be greatly below you in the social and educational scale. On the farm is your opportunity to advance it. Let the hours of toil be so arranged that the body, not over fatigued, may find refreshment, and the mind education in the reading and study of the newspapers and books which your home is permitted to possess.

By such care and attention you prepare the way for labor to possess education and own capital, and in its turn become the employer and educator of other labor.

I have referred to surplus labor. So much of this class crowd our villages, towns and cities that the farmer does not so fully feel its pressing demands, Where does it come from? Well, my friends, owing to the boundless freedom which our National constitution offers to the people of the world much of it comes from foreign shores. In 1885 there came to this country 326,411 foreign-born people. This number was 76,819 less than the number of those who came in 1884. Of this 326,411 foreign-born people who came in 1885, 104,904 came from England, Wales, Ireland and Scotland; 106,910 came from Germany; 114,597 came from various other countries, among them 15,689 from Italy. Some of these were undoubtedly mechanics at home, but already the workshops and manufacturing industries here are overcrowded, and all become seekers after any kind of labor. A portion may have brought funds sufficient to settle on the new farm lands of our western country. The question is, what shall be done for those who want work? Already labor organizations throughout our land are agitating the reduction of the hours of labor in many industries to eight hours per day, thus hoping to create a demand for the unemployed, as well as secure greater opportunities for mental and physical improvement of those already employed. What can the farmer do to assist in reducing the quantity of surplus labor? Have we not answered the question already? Use the capital produced by labor to aid labor in becoming the possessor of capital. This does not express a socialistic idea of dividing property with others who have not earned a right to it, but it simply means what we have said before, that labor employed at fair remuneration adds to accumulations already started and helps to its own accumulation.

PUBLIC POLICY AND FARMERS' ORGANIZATIONS.

BY ROBT. ALWARD.

[Read at Hudsonville Institute, February 3, 1886.]

I shall not follow the beaten path usually taken on this subject, but will ask you to consider with me from a standpoint above and beyond partisan politics. Whether the existence and rapid spread of private corporations which invade private enterprises is not a standing menace to the progress of our country, and the existence of the liberties of the people; if on the one hand I condemn organization, and on the other hand advise the farmers to organize, my excuse is, we must meet the invaders with an armed force, and if private corporations are invading our interests and diminishing our profits then it becomes our duty to organize in self-defence. There is, perhaps, no higher or more important duty devolving upon an American citizen than that duty which requies him to study closely every danger than menaces civil liberty in this government, and tends to usurp the rights of private individuals.

If we turn to the history of the old world, and nearly every page of it is written in blood, we find that nearly every instance of internal dissention and revolution which the nations of Europe have passed through, were caused by permitting the avarice, luxury, and vices of the few to flourish at the expense, and by the labor of the multitude.

Such was the condition of Rome. Such has been the condition of England, and continental Europe for centuries. The fury of the masses, in many instances, when they had been driven to desperation by the oppression of those in power, exceeded all power of restraint, and left desolation in its track.

There was some excuse for those ignorant, misguided people; they had never known the blessings of liberty and self-government, and knew no other way when the rights of individual man began to dawn upon their minds. No other means but violence would have had any effect on those that governed, to make them to a limited extent, respect the rights of their subjects.

The first grand success achieved by the masses against despotic power, was when the commons of England extorted the great charter from that tyrant, King John. A charter which acknowledged to a certain extent the individual rights of mankind, to which for ages afterwards, patriots have looked back as the basis of human liberty. Even then their hopes of justice and liberty only partially realized, and after combating for centuries the tyranny of kings and priests, a few resolute spirits turned their backs on the homes and scenes of their childhood and sought freedom in America, that coveted boon which had been denied them in the land of their fathers.

They were so imbued with the belief that they still belonged to somebody that they must needs allow the hand that oppressed them at home to follow them across the broad ocean and enthrone itself their master here, and they found in a very short time that they had simply transferred the evils from the soils of England to the wilderness of America, where monarchy was destined to meet its overthrow. How heroically the descendants of those patriots in after years labored by all peaceful means in their power to gain from their oppressor those principles of equity and right until forbearance ceased to be a virtue, is familiar to you all, and how the principal actors in that great drama met in that historical building, Faneuil Hall, and there promulgated principles that revolutionized the social condition of man. Principles which dethroned a king, and enthroned the people.

The noblest of all the great principles proclaimed in that grand instrument, the Declaration of Independence, is expressed in these words, "that all men were created *equal*, and should be protected in *life*, *liberty*, and the pursuit of *happiness*." The thought probably never entered the minds of those public benefactors, as they sealed those principles with the blood of thousands of patriots, that before a century of national life had passed, a people having once enjoyed the blessing liberty, would, through their representatives in state and national legislatures, enact laws, making it possible for a few individuals acting in a corporate capacity, under chartered rights, to so direct their own business and the public policy of the country in their own interest, as to invade individual rights, divert civil liberty and overshadow the very government that created them.

This, fellow-citizens, in my opinion, is to a great extent the condition of things to-day in this, our boasted land of freedom. You can scarcely point to an industry except agriculture, but what is conducted in some form or other, under corporate management with rights and privileges granted them by the State and fostered and protected by it. A business, which a few years ago was considered within the province of private enterprise or common partnership, now becomes incorporated; and the result has been that there has been more discontent and more dissatisfaction between employers and employed, between labor and capital during the past ten years than there has been from like causes during all our previous national history. So great has been the difficulty in some instances that the strong arm of the military has been called upon to restore order and maintain the peace. When we consider the harsh and inflexible conditions imposed by corporations over those dependent upon them, is it to be wondered at, that the private individual finds himself unable to compete with the centralized capital of a corporation of men. Should he make an effort to do so, he will find himself so surrounded by their power that there is no alternative left him but to close up his private business, enter a corporation with others in self defence or become the servant of one.

The tendency is evil, and only evil ; it discourages pursuits by honest private industry, and accumulates the masses in large numbers at manufacturing centers, where the extremes of luxury and poverty meet; where you find thousands of laborers employed, and not one that is able to manufacture, entire, any article upon which he works. The individual, independent mechanic is fast becoming a thing of the past. This of itself is what makes them so utterly dependent upon the will of those who can shut down their works or reduce the wages of their employès whenever the market does not suit, or from any other cause they may see fit.

You may say the progress of the age demands this, and point with pride to our flourishing manufacturing institutions, as conducted under corporate management. England points with pride to like institutions, and we point, with feelings of sorrow and commiseration, to her destitute millions. We are duplicating their system in this country at a rapid rate. It is a false progress that fosters monopolies ; that makes aristocrats of the few, and surrounds private enterprise with a rival with which it is unable to compete. To justify the system because it tends to cheapen manufactured articles is poor defense, when it can be shown that it tends to cheapen an article of far more importance, *i. e.*, manhood. I would sooner pay a higher price to an enterprising mechanic for the article I purchase than to pay a like amount to an army of soldiers, or a force of police, to protect those monopolies.

I condemn private corporations, because they tend to demoralize to a great extent all connected with them. They have their origin in one idea—that of money-getting. The individual is merged into a money machine, of which he becomes a part, and he feels no remorse of conscience so long as it produces gain. Men acting in a corporate capacity will claim rights and take privileges that a private person would not dare to claim, and could not enforce them if he did. The price of their favors is unquestioning obedience.

According to their standard, a modern financier would be unworthy of the name if he did not understand how to make the business pay dividends on watered stock, representing sometimes twice the amount of cost.

Stockholders will draw twenty per cent on their investment without any compunction, when, if you were to charge them with being twenty or thirty per cent men in private business, they would take it as an insult to their manhood.

There are, however, some enterprises that would seem to require special rights and privileges, such as railroads, canals, expensive bridges and such works that, on account of their magnitude, are beyond the ability of private enterprise ; and even in those matters, in granting extraordinary rights to such corporations the rights of the people should have been carefully guarded. But have they been? Let us consider railroads for instance, and I am going to admit in the start that they are a necessity of our civilization, and have contributed wonderfully to the development of the country, and to the convenience and prosperity of the people. Some people, however, are so given to enlarging on the benefits the country has derived from railroads that we might be led to believe that railroad companies had built railroads for benevolent purposes, out of pure charity. I am inclined to the opinion that the charitable part has been with the people, or more properly with the government that represents the people; for in granting them those extraordinary rights which railroad corporations enjoy, the Government did not protect the people against exhorbitant rates, or prevent the companies from making unjust discriminations. They are at liberty to charge whatever the article would bear, with the exception of passenger rates, which have been fixed at three cents per mile. Those were the rates asked and received twenty years ago, in high priced times, and the people are paying the same to-day, notwithstanding nearly all the property has shrunk in value from one-half to two-thirds.

It takes about as much property now to pay three cents as it would have taken twenty years ago to have paid nine cents per mile; and the discriminating manner in which they deal with their patrons is such as ought not to be tolerated. I do not claim for a moment that a railroad company should carry a bag of wheat for me at the same rates that they ought to receive for a car lot; but I do claim that they ought to be compelled to furnish me a car just as cheap as they will an individual who may come to your village and advertise himself as a grain buyer. He does not produce the grain and there would be just as much to ship if he had not come. He simply steps in and absorbs profits that we, as farmers, might receive by shipping our own grain to better markets. Were it not for the discriminating rates given to the so-called dealer, and this evil affects those engaged in mercantile business, as well as farmers, large dealers would not have such an advantage over smaller ones, and competition would be fair.

I wish further to call your attention to the enormous amounts of public land that have been given to railroad corporations. It would seem to me that a paternal government, having the best interests of the people at heart, and with a full knowledge of the evils that afflict the masses in European countries, on account of the monopolies, would have protected the people here against a repetition of the same evil, and would have held the public lands to be parceled out in small quantities to actual settlers, as a means of absorbing the ever increasing population of the older sections of the country. But what are the facts? We find by the government estimates published that, if in all the land granted to railroad corporations, none of it had reverted to the government through failure of the corporations to fulfil their contracts in the construction of the road, etc., it would have taken two hundred and sixteen million acres of land to have satisfied the claims, and in 1880 the railroad companies still owned, according to the census, seventy-eight million acres, an amount equal to about one-seventh of all the farms in the United States. These figures are almost beyond our comprehension, except by comparison. When we consider that there is only about thirty-six million acres of land in the State of Mchigan, and that it would have taken a territory equal in extent to nearly six of the State of Michigan to have satisfied these grants, and that in 1880 the railroad companies still owned lands equal to two and one-sixth of the State of Michigan, we can form some idea of the magnitude of the gift.

Friends, was there ever such a magnificent gift made on earth? If so, I have never heard of it. I have read of the gifts Queen Elizabeth made to her court favorites, when she confiscated large tracts of land in Ireland for that purpose, and further back in history when William of Normandy parceled out the English farms to his Norman adherents; but these all sink into insignificance when compared to the gifts of lands and money made to railroad corporations by the people of America. The policy pursued by those corporations since receiving those lands has been in direct opposition to the interests of the farmers of this country; for in order to dispose of their lands and to furnish employment for their roads they have them advertised in every country in Europe, and while they will charge you and I about twelve dollars a day to ride on their roads, they have secured rates across the ocean that makes it possible for the poorest Europeans to reach our shore. The ocean fare for emigrants was reduced to seven dollars from Liverpool to New York, and the railroads have carried them from there to Chicago for one dollar, and to this influx of foreigners to our western territories may be charged to a great extent the present reduction in the price of farm products.

The evil is still more aggravating when we consider that according to the census of 1880 these same railroads were estimated to be worth sixteen millions of dollars more than they cost, notwithstanding a great many of them were built in high-priced times. They are about the only property that does not show a shrinkage in value. It is conceded by everyone familiar with our form of government, that a republican form of government to be successful must depend upon the education and general intelligence of its citizens, and while our government has been giving hundreds of millions of acres of land to railroads there has been but sixty-seven million acres given for educational purposes. Yet so fearful has our government been of creating monopolies in some instances that there is a law on the statute books prohibiting any *charitable* organization from owning over fifty thousand dollars worth of real estate. Further comment is unnecessary.

As we look about us what do we see as the result of those vicious practices? We see in almost every town or city of any importance men that are worth from one million dollars upward, and some that can count their wealth by the hundreds of millions, the most of which has been accumulated during the last twenty-five years.

We see mighty corporations towering above the heads of the people, intimidating their employés to vote in their interests, controlling our legislators, filling public positions with creatures of their own choice, never satisfied after having acquired more wealth than they can possibly make use of, but continually crying *give, give, give!* Bowing before their power we see a great mass of humanity, unable to understand their social inequality, murmuring their discontent, and, like the slumbering volcano, ready to break forth into fury.

My friends, the picture is not overdrawn, and we turn from the sad scene with but one hope of relief and that is to the farmers of this country, for I tell you candidly you have a charge to keep. It is for the conservative home building, home loving farmers of this country to stand arbitrators of this nations' destiny, between those two contending elements I have mentioned, and turn back the hand that oppresses, re-assure the discontented and protect the liberties of the people. The future prosperity and welfare of this country depends more upon you who are owners of homes and around whose firesides cluster the patriotism and private virtues of our race, than upon any other class of citizens. You can accomplish those objects as successfully in no other way as you can by obeying the central law of our civilization, which is: organize, form farmers' organizations, or unite with those already formed; where you can discuss public policy, harmonize your views and work intelligently together for your own protection and for the general good of your country. You have a farmers' organization fully established, known as the Patrons of Husbandry, and if there is an individual present who is prejudiced against that association or inclined to underestimate the good that it is doing, I wish to say to him without fear of successful contradiction, that the members of the Grange, though few in numbers compared to the great mass of farmers are doing more to educate the farmer in his public duties, to shape legislation in his interests, to protect the farmers against unjust claimants, and to make the occupation of farming as respectable as any other business. This organization meets with more opposition and ridicule from outside farmers who ought to be wishing it God speed, farmers that have been more or less benefited and protected by the Grange than it does from men of other occupations. Business men understand the benefits of organization and co-operation, and are well convinced of the fact that where a number of persons are engaged in the same business or calling, the welfare of each to a great extent is bound up in the good of all, hence they pool their interests and co-operate for their mutual benefit. They respect the farmer whose intelligence prompts them to make an effort in the same direction.

Farmers should organize for the purpose of self-improvement, for developing the latent powers of the mind, not alone for himself but for the benefit of his wife, sons and daughters. They could bring their ideas and experience in contact with ideas and experience of others and thereby acquire that address, self-confidence and ability to intelligently express their ideas either in public or private, that is so essential in influencing the affairs and minds of men.

The farmers' isolated manner of living makes something of this kind more essential to him than to men of other callings whose business brings them into daily intercourse with their fellow men, for it is by the contact of individual minds that knowledge is acquired and increased. Farmers should organize for the purpose of becoming more proficient in the business which they follow. They should bring their experiences of farm and household matters to a common centre, for a mutual exchange of ideas and to receive new suggestions. Men of other callings do this, and why not the farmers? They should organize to aid each other in securing a first remuneration for the products of their labor and learn to make half of the bargain in the business of life as do the merchants, the lawyers, the doctors and the millers.

Farmers, you have helped those organizations long enough. Is it not about time that you helped to support the organization that helps support you? You have been defended against the plaster monopoly, you have been defended against several unjust claims for infringement of patent rights and you have another claimant treading on your toes. It is the infringement on the spring tooth harrow, and in this matter you will not be defended by the grange unless you are members.

Take your wives, your sons and daughters with you into the Grange, where they may have sociability, that will help to refine their lives, enlighten their minds, and give them self-confidence. Teach your boys that tilling the soil is not a low, menial calling, but that it is as honorable as any calling known to man, and that the more intelligence they manifest in their business the more honorable they make themselves, and their occupation teaches them that it is more honorable to be a whole farmer than it is to be a half mechanic; that it is more honorable to be the owner of a farm, sitting by your own fireside, and owner of yourself, than it is to be the paid servant of any corporation; that the individual that strives to live on the unpaid labor of others is a thief, no matter whether his position in society be high or low.

To you farmers that are not members of the Grange, do not excuse yourselves from, or condemn its principles, because some individuals have joined who afterward proved false to the principles they advocated.

The members that are honest in their efforts to better the condition of the farmers, and the great majority of them are, regret this very much more than you possibly can.

To you that are members, do not become discouraged because occasionally a brother is willing to prostitute himself to some soulless corporation that may wish to use him to further their own interests, notwithstanding he pledged to you on his sacred honor to guard and protect the principles of your order, he is a better judge of the worth of the honor he pledged than we are—let him go. Let us say to ourselves, "Brother farmers, this is our country, and is to be the home of our children after us. Let us work together in unity of principle by organized efforts to protect its free institutions, so that if our children do not live under a republican form of government and enjoy the blessings of freedom, they cannot say the fault was with us; that we had bartered our birthright for a mess of pottage. Tell your children the story of our first revolution, the causes for which the founders of this government labored, fought, and conquered; place in their hands the Declaration of Independence and the constitution of this country, that their teachings may be preserved.

Dr. Godfrey: Having had frequent opportunity of meeting with farmers, I used to find it in farmers' school meetings a rare thing for young men to be able to express themselves in public; whereas, now the influence of the Grange has greatly changed this, and familiarized farmers with public address, and, by practice, taught them fluency and parliamentary form.

Mr. A. Clark: If Mr. Alward had signed my name to this paper, I should have been satisfied. There is no ignoring the fact that organization is in the very nature of man, and it is useless to oppose the tendency. From the time when Adam and Eve organized for their little unlawful schemes, men have organized for all sorts of purposes—lawful or unlawful. Military organization secured the leadership of feudal chieftains which lorded it over men's bodies, and ecclesiastical organizations have lorded it over their souls. Now men organize against tyranny for their own freedom, and our government is planned for the good of the governed. And yet under this system, still, are organizations for the gathering in by the few, of the fruits of the toil of the many. The boot blacks organize for 10 cents a shine. The hack men organize and ask as much to carry you a mile as would pay your fare half way to Jackson. The doctors organize and hoodwink their patients with Latin formulas, and the lawyers, to get $10 for a half day's work of three hours. The farmer, without organization, works twelve hours for 80 cents. He carries his wheat to market when it is raised, and finds that the dealers have discovered an immense glut, and wheat is down. He sells, and wheat suddenly rises.

If manufactured wool is threatened with free importation, the manufacturers send a lobby forthwith to Congress, and woolen goods are protected. Yet raw wool is free. The only remedy is for farmers to work together, to organize, and see to it that their rights are looked after. Let your boys feel that agriculture is honorable. Send them to our Agricultural Colleges, rather than to Military Academies. Give your girls, through our Granges, social life, and they need not blush to be farmers' girls. They will learn to appreciate the men of the country, and be justly proud of belonging to the best aristocracy—that of the land.

Pres. Willits: I am looking for light on this subject. Tweed said when he had stolen his millions, "What are you going to do about it?" Wm. H. Vanderbilt is credited with exclaiming when reminded of the rights of the people, "Damn the people!" It is all very well to meet and talk about these things, but the question is what can be done in the case. The farmer does not fix the prices of his products. How are you going to manage it that he shall do so? In 1873, I was one of a commission appointed by Gov. Bagley to revise the constitution, and yet, when we submitted the amendments, you buried them so deep Gabriel's trumpet would not raise them. You talk about corporations. That constitution placed restrictions upon them and you voted it down. Our constitution provided against consolidation of competing railroads, but the railroads evade the provision by leasing, thereby having all the benefits of consolidation. The revised constitution provided against that, and you voted it down.

One hundred years ago, London had no lighted streets, and men went about nights with lanterns. The ordinance provided against any one being out after a given hour without a lantern. It was evaded by having lanterns but no candles. So the ordinance was amended by requiring lanterns with candles in them. It was again evaded by having unlit candles. So it was again amended by requiring a lighted candle. It took legislation three times to get the ordinance so that it would hold water, so to speak.

So with this corporation legislation. Up to this time there has been legislation and evasion, and too frequently the people have not sustained the legislature, or the men who have sought to limit and restrain, and I confess that I am discouraged. It is a difficult subject. We cannot get along without corporations. Know what to do? The individual charges you for half way across Grand Rapids what the corporation will take you half way to Jackson for. Give the devil his due. Don't kill off corporations, but control them. Fire is a good servant, but a bad master. So of corporations. As to discriminations. I had the pleasure of voting for the Reagan bill, in Congress. It provided against charging more for a short haul than a long one. Nevertheless, in so doing, might you not make other difficulties in curing some. Organized capital is the principle of the age and we can not go back to Chinese methods they have no corporations. Instead of steam, men transport and are beasts of burden. As a consequence they have no poor-houses, a few rich men, but for all that we don't want to go to their methods.

Beecher says if our foresight was as good as our hindsight, we would all get rich. So of land grants to railroads. When they were made, we all favored them. Any company will vote a tax to gain a railroad, and when it comes to paying the tax they growl. So as to giving lands to railroads.

Hon. Geo. F. Richardson: President Willits has just found himself swamped with the question as to what is to be done. It is a difficult question. Still as they did in London, requiring first the lantern, then the candle, and then the lighting, so we may get toward our point step by step.

One of these steps is organization and sending men to make our laws who are seeking the solution of these problems in sympathy with ourselves, that they may cut and try until they do succeed.

Last winter when it was proposed to tax mortgages the money-lenders contended that this would oppress the borrower.

So as to legislating against butterine, they say, "No use, the only way is to make better butter."

I think legislation can do something for butter making. We have all sorts of industries protected. Why not some farmer's industries? I would legislate against bogus butter as against bogus money.

Some one says: Yes, you passed a bill, and what did it accomplish ?

True; but it was before we knew that the N. Y. law was unconstitutional. Our law may have been the unlit lantern, but perhaps we can yet get the lantern lit.

Those who oppose legislation say, make better butter. But while we can detect poor butters you cannot detect hurtful butterines. I saw last winter a Buffalo cattle dealer who said nearly all cattle dying in transit are used to make patent butter. If true, this should be legislated against.

One thousand tons of bogus butter can but displace 1,000 tons of good butter. Being made more cheaply it can undersell butter.

The New York dairy commission mentioned 60 ingredients used in making bogus butter, including nitric and sulphuric acids, and many other disagreeable substances.

Do you want this stuff to displace the dairy product? Legislation should check it. Perhaps we can tax it out of existence.

We can boycott the hotel that uses it, the dealer that sells it, the candidate that will not oppose it. The Grange can do much in this direction.

I wish to say a few words about taxation. Most people think taxes high, particularly the State tax.

The legislature has been liberal to the Agricultural College and the University, and our other institutions need large sums, but it is rather in the method of distributing the tax than in the amount that the injustice and the hardship come in.

The capitalist who can conceal his property escapes his fair share of the tax, or if taxed he can leave before his tax is collected and escape completely, or he can leave when the assessment is made and come back afterward, while the farmer has to bear his own burden and that of such capitalists to boot.

Laws can help this and farmers can ensure having laws that will help it by demanding candidates who favor such laws.

I think all real estate mortgages should be assessed as real estate, and the amount deducted from the debtor's assessment.

Compel tax statements to be given under oath. It is said this will cause perjury. It will at least tax the conscientious owner, and would not hurt the farmer, whose property is all visible.

Judge Ramsdell found that this plan had been tested by the Oregon Supreme Court and stood the test.

Discrimination in freights is a most difficult subject to deal with, but one as to which effort must not be remitted. The bill for this purpose last winter never reached a vote in the House.

But State legislation is weak and this subject must be dealt with by Congress.

Then, too, in this State, our present constitution is constantly in the way.

Even when the House reached the point of doing something, the Senate was not pledged to the farmer and stood in the way.

As to the patent right swindle, Congress should take hold of this, and hold the consumer harmless. The manufacturer should be dealt with.

Mr. Weatherwax: We would like to hear from President Willits as to legislation on mortgage taxation, railroads and patent rights.

President Willits: As to mortgage taxation, I am free to say I don't know what to do. One of the chief evils of taxation is the escape of large blocks of personal property from taxation. In Adrian were two men in similar houses, who paid similar tax. Both died near together. One was worth $1,000, personally, the other was worth $90,000, bonds of other cities. Mr. R. says a mortgage owned by a man in New York can be taxed here. The trouble is, it can be taxed there, too. He is there, and they would not recognize the fact that he may have been taxed on it here. You farmers who owe $1,000 on a $5,000 farm, pay tax on one thousand more than you have. I believe this difficulty can be met. Some intelligent people say, put all tax on real estate, and they point to New Jersey, which did so, to the enhancement of value to real estate. But there are difficulties.

As to railroad discrimination, the evil exists, and it will be solved some time and way. There is no reason for charging more from Battle Creek to New York, than from Chicago to New York. In many cases there are constitutional difficulties in the way, *e. g.*, as to butterine. Suppose we prevent it being made here. They may make it in Ohio and sell it here, and we can't prevent it, under the U. S. Constitution.

As to patent rights. The consumer can no more take the right to use a patented article than he can take a horse, but we can say that, unless judgment for $20 or more is given, complainant must pay costs. But while legislation will do some things, it will not put brains in a man's head, nor protect a foolish man from the oily tongue of a beguiling swindler. The American must learn to do something to take care of himself.

SUCCESS ON THE FARM.

BY HON. WM. BALL, OF HAMBURG.

[Read before the Farmers' Institutes at Rochester and Grass Lake.]

How shall we manage our farms that they may be made more productive, and at the same time pay for their increased fertility and yield an income to the husbandman? what varieties of grain shall we grow, and how many? what kind of stock shall we breed, and what kind of care shall they receive? are all questions of practical importance and none can safely be ignored, but all should be well considered by every thoughtful, intelligent farmer, for upon the correct solution depends very much the success or failure of farming operations. To answer our first question with anything like certainty, we should know a good deal about the nature of the soils we cultivate. I speak of soils, for hardly any farm of much size but has several varieties of soil and hence need different treatment and modes of culture, and cropped with different kinds of grains. One should ascertain by reading and experiment what certain kinds of soil lack to make them the most productive and how they should be treated in order that plant growth shall be the most rapid and enduring until the crop is matured. The analysis of the different kinds of grain raised should be well understood; what properties compose them, what those properties need to best develop them, and then know what soils are best calculated to produce them; in other words, there should be an affinity and sympathy between the soil and the grain planted or sown. Much of this can be learned from reading the scientific experiments made in this country and in Europe, and though people fail sometimes in applying them, the fault is not with the inaccuracy of the report of the experiments but in the manner of their application. Theory and practice are both good teachers, and when taken together in a thoughtful and considerate manner as applied to crop growing are generally productive of good results. In my opinion too much farming is done by guess work. A farmer has a field he wishes to plow and sow. In too many instances he considers what is convenient to him rather than taking into account the capabilities of the lot to produce the best possible results. He plants a field to corn which is better adapted to the growth of oats or barley, and another to oats which is better adapted to the growth of corn. The result is a loss in both directions. If water is liable to stay near the surface, it is imperative that it be removed by under-draining. If the soil is of too arid a nature then these fertilizers which tend to gather and hold moisture, such as salt, gypsum or plenty of well rotted manure from the barnyard. Thorough tillage is a necessity to good crops. The land should be so thoroughly pulverized that the most delicate roots of plants may penetrate it and find nourishment. No good gardener would think of putting his garden seeds in a rough lumpy seed bed. because he knows that they would not so surely germinate and if at all will not grow so rapidly and strong. The same principle should be applied in fitting the ground before any crop should be planted. Better fit and till one acre well than two poorly. Good healthy seed should always be used. It is a truth that something cannot be produced from nothing, and it is equally true that you must add to the soil you till as much or more than you take from it, or the soil will become leaner and less productive. This may be done in various ways. An occasional deep plowing, bringing up a sub-soil and placing it where it can come in contact with the sun and atmosphere; by sowing grasses whose roots penetrate deeply into the earth such as clover and then plowing it under. Plaster, as it is called, is good upon crops which are to be plowed under, as it is supposed to have an affinity for any ammonia that may be floating through the atmosphere, thus attracting and holding it until the rains carry it into the earth when it becomes plant food, besides what finds its way by absorption through the leaves and stems of plants, to the roots giving them succor and strength. Artificial fertilizers as a rule for general farming are too expensive for what they contain and the average farmer must utilize such materials as are at his command. To the second question, what kind of grain shall we raise, much depends upon the soil, the nearness to market, and the taste of the farmer. With the low price of wheat, the high price of land and labor, wheat raising alone is poor economy. The comparatively high price of beef, pork and mutton should be an argumen in favor of raising corn, oats, etc., and it is equally true that they should never be sold except in the form of beef. Raise as many kinds of stock as can be made profitable always being sure to keep no more of any or all kinds than you can keep well. Always have a variety of products to depend upon as with some of each you cannot miss of having the most profitable.

Sheep are a necessity, as they are needed to keep the farm free from weeds and other foul stuff, and as they also yield a semi-annual return—wool in the spring and lambs in the fall, if sold. Always keep in mind the maxim: "When everybody wants to sell, then is the time to buy, and when everybody wants to buy, then is the time to sell." The wool industry is no more depressed than a great many other industries, yet farmers have been getting rid of their sheep at a sacrifice, thereby killing the goose that has been laying the golden egg, and these very same farmers will soon be trying to purchase another goose at a much increased value. The mutton breeds of sheep have their uses, and in certain localities are preferable to the Merinos, but that they can become the universal sheep for this country is entirely imaginary. The available sheep lands in the other parts of the world are on a rapid decrease, and the demand for the wools from the sources of our foreign supplies is on a rapid increase. Foreign wools will no longer be so cheap or abundant as in the past, and it follows, then, that the supply must be made good at home. We have plenty of cheap lands west, we have plenty of good sheep lands in Michigan, which are being depleted by this depression and scare, and you and I who have kept our flocks intact, or added to them, because we could buy so low, will in a short time be called upon, at good prices, to make this depletion good. It is claimed by some that the west should raise our wool and the east the mutton. The history of the past proves that improvements in sheep breeding have not been made in the west, where everything is done on a large scale. The great improvements in our highly valued Merino have been made where farms were small, flocks few in number, and by men who gave their personal care and best thought to their improvement. So it will always be. The east will still be called upon to furnish the choice specimens of her thoroughbreds to improve the common flocks of the west, and the demand will be imperative and profitable to the breeder who stands by his sheep through fair or foul weather; never losing sight of the fact that half the battle is in favor of him who never falters in well doing. To the breeder of the thoroughbred Merino, I would say, don't be discouraged; stick by your pets and they will pay you well. When they are low, increase your flocks; for the day is not far distant when there will be a good demand for all of your surplus. Look over any wool circular, and you will see fine wools strong, combing and delaine wools scarce, while if there is any stagnation in price, it is on middle and coarse wools. Feed those sheep getting old; also the light shearers, for the butcher. Weed out the short fleeces, yellow-colored, long-legged, bare-faced ones, and feed them also, as they have no business in a good flock of sheep. Breed from no males but thoroughbreds. Increase the size of your sheep by proper selections and by liberal feeding. Grade Merino wethers may be made to weigh, when three years old, from 125 to 140 pounds, and in our markets the price will average well with those called the mutton breeds. Usually towards spring they bring more per pound, owing to the fact that they are as desirable mutton for the average American, and their pelts are worth very much more, owing to the larger amount of desirable wool. Another thing to be taken into consideration is the cheapness with which the Merino wether can be kept; their natural adaptation to our soil and climate, as well as their capability of doing well in large flocks. To breed for wool, care should be taken to select animals with good bone and robust constitution. Then see to it that they are covered from the nose to the extremities with a thick, long, desirable staple of wool, and then feed them in such a manner that the animal should be in good condition, but feed with especial reference to the amount of wool. Breeding ewes, of course, in winter, should be a partial exception. If you are breeding thoroughbred Merinos, don't go to extremes, either for size, wrinkles, short or long fleeces. Get as many desirable qualities in one sheep as possible. Be sure and have a good pedigree, one that means something, but don't take too much stock in the "Atwood" craze, unless the sheep are better than the "Atwoods" and Paular combined. Profits always follow a successful course of stock-raising. It is wicked to not give your stock enough food in the winter, thereby throwing away what flesh was gathered in the summer. Too much time is wasted in the winter. Too little thought is given to our business, as farmers. A farmer should know something of law and medicine, and he should have enough moral principle about him to be an honest man, and this comprises about all there is in the scale of human acquirements.

Mr Peabody: For profit, there must be back of the Merino sheep a fair price for wool, and that there is not at the present time. The mutton breeds, however, are always profitable. I breed Oxford Downs. They generally breed twins, and it is no trouble by good feeding to produce lamb wethers weighing 140 to 150 pounds at one year old, when they will sell for 5½ to 6 cents per pound.

Our nearness to markets gives us an advantage in production of mutton, while in wool growing it counts for but little.

My sheep unquestionably eat more than the fine wools. I admit freely that Merinos will live on a pasture when almost as thick as sardines in a box.

Mr. Ball: I do not especially advocate Merinos. I advocate anything that will take the place of scrubs, of those sheep that shear only 2 or 3 lbs. There will be many such sheared this spring. There are localities in which the mutton breeds will be best, but nowhere is the scrub the best. My point is, that a man who has become fitted by long years of care and study to grow wool or succeed in any other industry should not desert that calling because of a momentary dullness in that line.

CAN THE AVERAGE FARM BE MADE PROFITABLE?

BY J. J. SNOOK, OF ROCHESTER.

[Read before the Farmers' Institute at Rochester, Feb. 4, 1886.]

From my observation and experience I cheerfully say that farming can be made profitable on the average farm.

The question is not, does it pay, but can it be made to pay? There are many things necessary to a profitable consummation of any enterprise, and most of them are as indispensable in farming as in any other business. First, the successful agriculturist must know his business, and as the average farm must be managed on the mixed principle, largely, he must not only know how to till properly the different kinds of soil found on average farms, but how to propagate and care for the various kinds of stock, in their various stages of maturity, as well as to cultivate fruits, grain and vegetables, and all of these in proportions to suit circumstances, are necessary. Another requisite is careful buying and careful selling. Disregard in these will as surely take the profits from a farmer as from a merchant. Raise all the stock you can feed well, and if more is needed, purchase good substantial animals, remembering that fancy prices are not for the average farmer, and in selling do not forget that the buyers' business is to purchase as cheaply as he can. The average farm is situated, in this portion of the State, perhaps three miles from market, store and shop. This distance is traveled by team, man and conveyance many times in a year, and perhaps a third of those times for want of forethought, and that too in busy times. How often have we heard the remark, "Oh, I forgot it when I was down this morning," or, "I didn't think to take that along and have it fixed," or, "Oh, I might have known we couldn't get along with that work without those bolts and nails," and not only heard, but used the same language. How many half days and whole days has that "Didn't think" cost us in a year. It was clean cash out of the profits; the difference often between success and failure. That mowing machine or reaper was not taken to the shop for repairs until needed, then the shop was crowded with work and you had to wait just at a time when it cost perhaps the price of a yearling. There need be no waste time on the farm, notwithstanding the rainy and stormy days if those occasions are provided for as they should be.

The household part of farming is by no means unimportant. Some women can spend more money than a man can earn, and then not live well, dress well, or be happy. Others have leisure for pleasure, and are also a very great help in saving a dollar, which some one has said is worth two earned. Recreation and visiting are necessary and right, but the average farmer has no business to entertain as though he were a millionaire. A friendship that cannot be gained and retained except by letting business run to rack, and by sumptuous meals is not worth the having.

Need I speak of the careful selection of seeds and of thorough tillage? Is not the statement within bounds when I say that enough has been lost to the State of Michigan, from poor seeds alone, in the last twenty years to have built all her railroads? It is often poor practice to refuse to hire good help at a reasonable rate when needed, but if hired only to do your part of the work, it is not economy. True thrift is to put the spare dollars where they will grow, or bring back the equivalent of a good interest.

The money that you spend for some book that you never read, and no one ever will, is dead money, it will never grow. Good books and good papers, especially those relating to our business, and papers furnishing reliable local and general news are necessary, and no intelligent, thrifty farmer can be without at least some of them.

When you spend money for things that are not useful in some way, that money is dead, as far as you are concerned. There is a great deal of dead money in houses that are as large again as they should be, and much in yards that are neither ornamental nor useful. Energy and push are grand if rightly used, but energy must be wisely controlled, and push must be in the right direction, else both energy and push lead only to destruction.

Therefore in conclusion I would say, let head labor and hand labor be combined.

Think, plan, systematize. A little careful thinking has saved days and weeks of labor. Will we heed the foregoing requisites of profitable farming, or will we go on heedlessly, caring more for idle gossip and lazy shiftlessness, than for those conditions which make the average farm profitable?

And so our lives unless with thoughts and actions filled,
Are not much worth to us, or any of our kind:
They're blank, or like the garden left untilled,
No *profit* there we see, no beauty find.

Dr. Wilson: For 28 years I have known the farmers of Avon. There are now 146 of them, and in that time there have not been three failures.

H. M. Took: My law practice for the past 20 years has been especially among farmers, and I know that in that time the farms of Oakland county have trebled in value, though Oakland was an old county at the beginning of that time. I have observed that the farmer who does what work he can properly do has in each case succeeded. Agricultural success is more uniform than in other occupations. The boys are staying on the farm more than formerly because farm life offers more inducements now. I consider the farmers the most respected class in this country.

Mr. Graham: The day for producing wheat with profit on our high priced lands has passed, and the time for producing wool has nearly passed. Cattle can be raised in the west much cheaper than by us. What can we raise? We must try to raise what is needed at home.

Mr. J. Van Hoosen: I believe we can compete with the West in raising wheat, and can make money at present prices. Our statistics make it appear to cost 53 cents to raise a bushel of wheat. I think the cost is not over 40 cents. If we could employ 1,000 men we would get rich, but on our small farms we have but one or two men to make a profit on, yet there is made $500 for each man employed. Farmers pay thousands of dollars for the education of their children, and make the money on their farms. It pays the best of any business in the country.

Mr. Wm. Ball: Farming pays in proportion as the farm is well managed and well worked. It is a safe business, and furnishes most of the children who become eminent in other professions. Do not work the children over hard; give them proper literature, musical instruments, etc., and they will stay at home.

THE NEEDS OF AGRICULTURE.

BY SAMUEL JOHNSON.

[Read at the Grass Lake, Webster, and Eaton Rapids Institute].

To those familiar with the six oracles on agricultural topics, who paint in roseate hues the farmer's home, life, and business, who seem to believe and try to make others believe, that there is nought lacking to bar the fruition of his richest hopes, my topic may seem inopportune: The Needs of Agriculture.

I am inclined to think, however, that there are not many simon pure farmers, who have had the task of getting their bread and butter, of caring for their families, and laying by something for the rainy day, by the labor of their own hands on the farm, but will agree with me that agriculture, oldest of arts, has not yet such a full supply of knowledge and furnishings as will warrant us in saying, even in this enlightened century, that she has no needs.

Agriculture has needs, and while, from my point of view, I may not see her wants just as you see them, I shall hope that a little time occupied with this topic may be promotive of thought and therefore of profit.

I might speak to you of the commonly expressed and most important factors in successful agriculture, as for instance of the need of thorough tillage, which has been a cardinal feature in good farming since the time when Jethro Tull by careful experiment endeavoured to demonstrate that the fertility of land could be retained indefinitely by the most thorough disintegration of the soil. I might call your attention to the saving and application of manures, the use of commercial foods rather than commercial fertilizers on the farm—a matter much neglected in many localities. I could find a congenial topic in the need and value of improved stock, and the short-sightedness of those farmers who persist in retaining the scrub, when a moderate outlay would gladden their pastures and barns with thrifty, quick-growing, early maturing, and profitable animals. I might elucidate some lessons from the text " more grass needed and less grain " on many of our Michigan farms. The need of scientific knowledge in agriculture and of coöperation are trite subjects which have been much discussed in recent years, but whose place and work are hardly well defined.

Now it is true that all these are needs in agriculture. They are indispensable with certain limitations to successful farming, and words of exhortation in these directions should be heeded.

I do not, however, choose to dwell on these universally acknowledged needs. They are fundamental in good farming. To neglect them is to make failure inevitable.

Let me rather direct your thought to some of the needs apparent to every thoughtful mind, but alas, too often forgotten in the farmers practices.

In agriculture, as in other callings, the importance of little things and the need of giving close attention to mastering the details of practical work are quite too frequently underestimated. Human nature is prone to give attention to what are thought, often mistakenly, to be the larger problems of business and life, and so neglect the smaller, but as a matter of fact the essentials of success are more in the latter than the former.

With this thought in mind if I can place before you definitely some of the losses, the dissatisfaction resulting from neglect of little things in agriculture, I am sure I shall do you a service. This lack of attention to little things cannot, as a rule, be attributed to ignorance of what should be done and of the evils and losses resulting from the neglect to do. The fact is farmers too often *know* far better than they *do*. Insensibly and by degrees, they have become habituated to neglect important details in feeding and caring for animals, in sowing, cultivating, and harvesting crops.

To illustrate, is there a farmer in my audience to-day, who can take me into his barnyard and show me a calf, a heifer, a cow or an animal of the cattle kind and say truthfully, that the animal has, from the hour of its birth, received such food in quantity and quality, as was adapted to its age and growth; that it has always been fed and watered with strict punctuality, at proper intervals; that in all the details of care and feeding it has received such attention as its owner *knew* would secure the largest returns in profitable development? I tell you the farmers are few in number who can say this of any animal in their possession. Then think of the losses resulting from the simple neglect to take proper care to save seed corn, a loss some years amounting to hundreds of thousands of dollars. Of the foul weed seed sown with our cereal crops and grasses, farmers subscribe to the principle that like produces like, they expatiate on the value of clean pure seed and then plant corn that has a half dozen varieties on one ear and sow cockle and chess and then wonder and grumble because their crops are small in yield and inferior in quality.

How many farmers can tell whether the receipts from milk, butter, cheese and stock sold exceeds the value of the grain and hay fed to the herd. What of the returns from the sheep and swine as compared with the cost of keeping? What is the profit of growing wheat per acre with the market ranging from 85c to 90c per bushel? Does it pay to have large orchards on small farms or would the land pay better in grass or cereal crops? How many dairymen can speak positively of the milk yield of their cows and as a result how many poor cows are kept at a loss because there is no milk record? Here is a graphic description of the average dairy of twenty-five cows: Two extra, five very good, five good, five poor milkers, one kicker, two jumpers, and one that milks so hard that it costs all that it is worth to get it; of the remaining four, one has lost a teat and three are too old. My observation leads me to believe this description is not overdrawn.

These simple, homely illustrations of neglect are apparent in the management of too many farms and might be detailed at much greater length. They are serious enough to demand careful investigation. Why do some of our educated farmers continue year after year in the same old ruts without apparently making any effort toward better things in farm practice? Is it not in too many instances because they have not been trained in the details of good methods? If we should look over our farm acquaintances in any locality I think we should invariably find that our most successful farmers are not those who work the most hours and the hardest at manual labor; they work however with all their energies; but they have learned that the work of the hand needs to be directed, supplemented by the work of the brain. They have learned that it is the part of wisdom and to their mental and pecuniary profit to devote a reasonable amount of their time to thinking out and planning their farm operations—to the keeping of such records of their receipts and expenditures as will enable them to determine with tolerable accuracy whether their crops and animals are profitable or not. They have learned to value agricultural literature in book and periodical form. They take agricultural newspapers and read them. They are not men of one idea. They ride no hobbies. They are clear sighted and quick-witted to see and apply good suggestions, from whatever source they may come. Is there not a great lack of method in plan and labor in Agriculture? While it is true that there is no other calling in which it is so difficult to arrange details and methodize work, on account of variations of the weather and seasons, this fact does not absolve the farmer from making most strenuous efforts to plan and arrange his labor, system of crops, care of stock and all the details of his work in the most careful manner. The difficulties in the way only make it more imperative that there should be no lack of plans of well studied, well defined methods. Upon his fidelity and judgment in these particulars will greatly depend his success.

I aver as my profound conviction that more farmers find their calling a hard and unsatisfactory one, and the returns discouragingly meagre because of this neglect to study the situation and to make such wise plans, as quite likely such a study would have suggested. I presume if we should turn the horoscope and recall our life experiences we could, many of us, bring forth from the treasure house of memory striking illustrations of this fact. This planing and methodizing of details is the higher work in agriculture, here the power, the ability, the brain of the master are displayed. You will recall the old saying of the Greek "I would rather have an army of stags with a lion for commander than an army of lions with a stag for commander." So in agriculture; if the master, the farmer, has method, plan, generalship, his helpers may not be of the best; difficulties may beset on the right and the left, but he brings things into line, and ultimately conquers. In agriculture we want the vigorous, well balanced brain, the methodical habits and discriminating judgment as much, aye, more than scientific knowledge and brawny muscle.

What I desire to say is that agriculture needs to appreciate brains and common sense brain work more than she has done. While she discriminates closely and sharply between that which is really adapted to her needs, and that which is science, "falsely so-called," let her, at the same time, accept the lessons which science has taught and *experience proven*, and have faith in the efforts that are being made for the solution of the unsettled problems in her domain. And this need of method or plan leads naturally to another. The farmer needs mental discipline, the grasp of mind, the habit of thought, that results from the study of books, of men and things. It used to be the fashion for farmers to look with positive aversion, almost disgust, upon one of their calling known as a scientific book farmer. Possibly the pedantry, conceit, and unbalanced heads of some of these so-called sons of culture may have had much to do in provoking this antagonism. Be that as it may, in these days we are not wont to find intelligent farmers who undervalue, or at least scoff at *true culture* as desirable on the farm.

I do not mean by true culture any particular system of training, of education. (I might personally incline to that which is usually termed practical in a broad sense; but for present argument I choose to take even broader ground.) Any system of study in school, college, or university, the training secured in the competition of active business, by self study; any system that develops a clear headed, clean hearted, independent, self-reliant man will answer. There are many roads to Rome, so there are many legitimate ways to such discipline as I have suggested, and one may have had all of the opportunities possible and yet have only the husks of culture, but lack the reality—the jewel. Educated fools and boors, and dudes, while not met with perhaps as frequently as illiterate ones, are much more repulsive to all sensible people who do not stand in awe of titles and tinsel, and merit contempt more than the uneducated. Some persons who want it known that they are educated are always advertising the fact in large type and leaded lines; they want to go to the top round at once—to be commanders-in-chief from the start. They want nice clean work, soft places, no drudging for them. Vacancies are not wanting in the ranks. In life promotions are usually made from those who earn them in subordinate positions. It is easy and quite too common for some of the so-called cultured to sneer at drudgery. "But in every career, and agriculture is no exception, even the highest toil over details, takes the most time, and makes the heaviest drain on energies. In the sharp competition which our country feels now more than ever before it is the man who is willing to work with his hands, to master details" and attend to them personally, in short to engage in drudgery, who will find employment and promotion and their rewards on the farm as well as elsewhere. Education, however thorough, does not relieve anybody from the duties which devolve on our common humanity. And it is pedantry and conceit of the silliest sort, it seems to me, to vaunt our system of education, the one in which Ego was trained, and to berate all others as inferior. The truth is, all systems have their weak as well as their strong points. Conservative and temperate claims for any system to which we have pinned our faith, or which in a measure stands sponsor for the culture we may possess is the height of wisdom.

We need to lay more stress on the practical uses of education, of culture on the farm and elsewhere. What can its possessor do?—not so much what he can say. The accumulation of knowledge alone will not answer, but discretion, wisdom to use wisely, must complement the knowledge gained.

Practical education is the cry on every hand, and yet how many of the educational institutions of the country are failing to give young men, and women too, such training as will make them of real use in the world. As illustrating this fact, permit me to call your attention to a brief extract from the annual report of Chief Constructor, T. D. Wilson, of the Navy Department. He sharply criticises the system of education by which it is attempted at the Annapolis Academy to fit young men to build and sail ships. He says he finds that under this system the cadets are "compelled to devote exhausting effort and a profligate sacrifice of time to acquirements which, so far as actual ship-building is concerned, are empty accomplishments and mere abstractions," and adds:

> "I must express the opinion that much of what is now considered deep professional learning is shallow scholastic pedantry, which can only embarrass its possessor when confronted with actual work. What is then required is the perfect knowledge of workmanship and material; the ready perception of their excellence or defect; knowledge of men and money, and fertility of mechanical resources. It is only necessary under our laws for a candidate to have passed creditably through the Naval Academy to be immediately appointed as assistant naval constructor; nor is there anything likely to prevent such men, without practical experience or perhaps natural fitness, from being intrusted at an early date with vast and complicated constructions of the future navy. The Annapolis graduates are thrust upon the construction corps without practical knowledge of ship-yard procedure, and devoid of that all-important quality, experience in the management of men."

In writing this Mr. Wilson had in view only the naval academy and its graduates, with whom he has to deal, but the most of his observations may be generally applied to the educational systems in all our colleges, and when made general will be endorsed by no small proportion of our practical business men who have ever employed young graduates as assistants in their stores, shops or factories. Nearly all our colleges, and our academies as well, aim to fit boys for what are known as the learned professions, law, medicine, teaching and preaching, and the result is a profligate sacrifice of effort and time to acquirements which, so far as actual work in any other calling is concerned, are empty accomplishments and mere abstractions; and even in the professions the young man with all the advantage of a liberal education finds himself early in his career outstripped by those who have been "knocked about" in the world and have acquired knowledge of men and money and fertility of resources which they can bring into play at every turn instead of what is called "learning." Probably it is not to be expected or asked that colleges so revise their courses of study and change their methods of training as to cure this, but so long as they do not a boy needs to learn a vast deal after he graduates before he can succeed as a manufacturer, merchant or mechanic; and whoever thinks that the possession of the diploma, for which he has been striving for years, opens to him the door to fame or fortune in any of these lines of business is likely to be taught by very bitter experience that about the most helpless of mortals is a man with only empty accomplishments and abstractions to rely on.

At a recent meeting of the Industrial Association of New York City, William E. Dodge made some very forcible remarks, from which we quote as follows: "Industrial education is a step forward, and there can be no end to its growth. There have been a great many economic mistakes made; too much attention has been paid to higher education, as it is called, and too little to useful pursuits. Manual labor has lost its dignity. I am connected with an institution that brings me in contact with many young men who need assistance. Many of these are college graduates. It is difficult to assist them because, while they have a smattering of everything, they know nothing in particular, and are compelled to take positions, such as errand boys, that are worth to them only $3 or $4 a week. Our colleges are turning out too many doctors, lawyers and clergymen. What we want is to throw the force of the brains into the hands. Industrial education should be taught in all the schools, and intelligent, capable mechanics and farmers will be the result.

Let me next call your attention to what, my observation has led me to believe, is a pressing and growing need in many, indeed, I fear, in most agricultural districts. I refer to the need of giving more attention, of taking more constant, personal, intelligent interest in the common schools, the people's colleges, where probably nine-tenths of the youth of our State will receive all of their education, as far as schools are concerned. Those of us, and who does not? who remember gratefully the country schools, where our first lessons were conned, and our first inspiration quickened for an education, cannot fail to appreciate the sentiment of regard, if we do not fully agree with this rhyme of a local New England poet:

"Had I this tough old world to rule,
My cannon, sword and mallet
Should be the dear old district school,
God's Bible and the ballot."

I do not wish to be thought an alarmist; but I cannot help feeling that the growing tendency to patronize the town schools results too frequently in the gross neglect of the country schools. The town and city schools have the number of their pupils increased and their revenue from tuition at the expense of the country; but the loss is not merely a pecuniary one. I do not hesitate to say, and I think I can marshal abundant evidence to prove the fact, if it should be questioned, that there is no place in the world where the children and young people living on farms can secure the *fundamentals* of a good thorough English education as well as in the district school in their own neighborhood; and, I may add, at so little expense and with all of the restraints and endearments of home life about them daily; provided always that *good teachers* and such facilities for illustration and comfort are given as every school district, with the generous help of the State, is abundantly able to furnish.

We boast of our High Schools, our Colleges, our University, and well we may, for they are worthy of praise; but do we not too often forget that all of these are dependent upon the common schools. Without these feeders to the higher institutions of learning, there would be little need of colleges and University. It is true that from year to year we are sending out a large number of graduates; but the tendencies of the times and their college surroundings too often lead them away from the farm—to believe that agriculture does not offer so wide, useful and honorable a field of labor as the college-bred man has a right to expect. And so the towns and cities are overcrowded with men who might have made respectable farmers, with proper direction, but too often live from hand to mouth in the professions, and have pretty hard work to get the hand to the mouth at that.

In the report of 1883 the Superintendent of Public Instruction gives the following statistics as to the occupations of the 2,992 graduates from the University of Michigan for the ten years ending July 1, 1879, and also from the Agricultural college for the same time.

SUMMARY OF OCCUPATIONS.

University.	
Bookkeeper	1
Assayist	1
Artist	1
Architects	8
Bankers	16
Clergymen	30
Superintendents of City Schools	31
Journalists	31
College Professors	46
Business Men	94
Civil Engineers	78
Teachers	118
Druggists	151
Unknown	244
Physicians	753
Lawyers	1,370
Farmers, or one for every 150 graduates	19

Agr'l College Graduates for the ten years up to 1879		
Related to Industrial Arts:		
Farmers	69	
Fruit Culturists	8	
Professors of Agriculture or related sciences	10	
Instructors in Agriculture or related sciences	3	
Students in Agriculture or related sciences	2	
Agricultural Editors	3	
Apiarists	4	
Engineers	4	
Architect	1	
Landscape Gardener	1	
Veterinary Surgeon	1	
Sergeant, U. S. Signal Service	1	
Machinist	1	
		108
Business men		26
Teachers		18
Lawyers and Students of Law		16
Physicians and Students of Medicine		9
Ministers and Students of Theology		3
Editor of Newspaper		1
Deceased		5
		186

Nothing reflects more credit on the Michigan Agricultural College or has given it more reputation abroad than the fact that so large a number of the graduates are true to the spirit and teachings of Alma Mater and are engaged in agricultural pursuits.

But suppose that a fair proportion of the graduates of our university, colleges and high schools should engage in agriculture. The last report of the Superintendent of Public Instruction, for 1884, gives the number of graduates from the University as 401 in the classical, medical, law and civil engineering departments; the Normal School 102, the Agricultural College 30, Adrian 19, Hillsdale, Olivet, Kalamazoo, Battle Creek, not given, but a generous estimate will be 100, or say 650 from all.

The high schools probably not so many, although the Superintendent of Public Instruction does not give the number.

The census of 1880 gives the number of farms in Michigan as 154,000, and it is safe to say that more than one-half of our million and a half of population are engaged in agriculture.

It is then evident at once that even if a fair proportion of the graduates of these institutions engage in agricultural pursuits the supply would not be at all adequate to the number needed, and we are obliged to look to the district schools for the education of the great mass of our farmers.

Harper's Monthly tells us, on the authority of President Barnard, that the number of annual graduates in the United States is but in the ratio of one to about twenty-five hundred of population. Half a century ago, it was about one to two thousand. During that time the population has increased four fold, the colleges three fold, the aggregate number of students two fold.

In other words the graduates have not kept pace with the increase of population.

I do not refer to these facts in a critical spirit, or with any thought or desire to detract from the credit which is due to all of our higher institutions of learning, and to the grand men who have planned and made efficient our higher educational work in Michigan. To them and their work well done only cordial appreciation and praise, but I do it to round out and emphasise the proposition, generally overlooked in all our places for education, that for years to come at least a large proportion of our farmers' sons will receive all of their education in the county schools. The lesson I would impress is that, while we do all we can to encourage farmers' sons and daughters to avail themselves of the higher educational advantages of our colleges and university, firmly believing, that everything else being equal, the training thus secured will ensure greater success in life's work, let us not forget that in the country schools the farmers, the mechanics of the future are largely to be trained. It therefore becomes the sacred duty of every farmer, every citizen, and especially of every graduate and student of an agricultural college who desires agriculture to keep pace with other occupations and professions, to see that these schools are maintained at a high standard of excellence, so far as voice, vote and influence can contribute to such a result.

But what of the Agricultural Colleges in this connection, some may ask? We have a goodly number of these, and they annually send out a large number trained, as we hope, to combat these tendencies away from the farm, and to do yeoman's service in advancing the interests of progressive agriculture. Unfortunately, two theories prevail, and are advocated by the friends of the Agricultural Colleges. One is, that these colleges should educate young men for agricultural pursuits; that the animus, the morale of the institution should be unmistakably and emphatically in this direction. While not expecting that all graduates shall follow agriculture, and fully subscribe ing to the idea that every young man is in duty bound to choose that pursuit that promises the largest usefulness, it is but right to demand that the atmosphere, and all the influences of Agricultural College life should tend in no uncertain way in the direction of agriculture. The other is, that these colleges should train men to be scientists; that their graduates should mainly devote themselves to scientific investigation. This is a pet idea frequently among those connected with the schools of agriculture that are an annex to a great State University, and have but few agricultural students. They propose to make up in quality what they lack in numbers, and so maintain that these agricultural annexes are demanded and are of great importance, because a small per cent of the few graduates are successful in the scientific, rather than the practical work of agriculture.

This is a scientific age. The tendencies of the last decade or two have been very marked in opposition to the old and so long approved methods of education. Possibly we are swinging to the other extreme in our theories and practice, and laying too much stress upon so-called scientific training. True it is that science and scientific, so-called, cover a multitude of sins. Science is fashionable, and scientific is applied to almost everything. And so would-be aspiring scientists are often intemperate and arbitrary in their claims. One has said of such men, "Their intellects are mischievously crammed with science. How much we know is not the best question, but how we got what we know, and what we can do with it; and *above all, what it has made of us.* The tendency of training is now to subordinate the soul to that which should be merely its endowment and adornment, to turn the thinker into a mere walking encyclopedia, text-book, or circle of the mechanic arts; not to produce the highest type of man."

Is there not danger that this clamor about science may, nay, does, often turn the heads of young men from agriculture? I have sometimes thought that there was too strong a putting of the claims and promises of science as opening the pathway to fame and fortune to young men, who have at Agricultural Colleges sought for a practical education, and too little stress and emphasis laid upon the field of honor and usefulness open before them on the farm, in actual agriculture. That the sympathies and labors of all interested in Agricultural Colleges should tend mainly in this direction, rather than in the other, I most firmly believe. If it had been so from the beginning, Agricultural Colleges would have been less criticised and vastly more useful and popular with the people.

Not that true science is to be discredited, nor one iota detracted from the large credit due to real scientific investigators, but in the language of one whose years and position in the scientific world give weight to his utterances: "I deprecate the claim to special attention made by inexperienced stumblers on forgotten or unnoticed facts, on the sole ground of discovery, and who babble over the most profound questions, when the amount of their efficient work in any branch of science is measured with a foot rule; while those whose entire lives have been but one exhausting struggle with the shapes which people the darkness of science, speak with bated breath and downcast eyes of these great mysteries."

So far as Agricultural Science is concerned, have we not too many claims and theories from scientists of the kind first described ? ready babblers on everything that relates to the theory and practice of Agriculture? (Go ye not after them. They are blind guides.) They offer floods of advice on subjects of which they have the most superficial knowledge. These penny-a-liners are ready to traverse any subject in Agriculture or Horticulture at a moment's notice. Wise in theory and ready in utterance, they rarely test their theories or practice what they preach.

Bulwer in one of his essays tells an admirable story which illustrates the follies of this class as well as the readiness with which those who are studiously intent on real improvement apply the knowledge that chance throws in their way.

"A certain nobleman, very proud of the extent and beauty of his pleasure grounds, chancing one day to call on a small squire whose garden might cover half an acre, was greatly struck with the brilliant colors of his neighbor's flowers 'Ay, my lord, flowers are well enough,' said the squire, 'but permit me to show you my grapes.' Conducted into an old-fashioned little greenhouse, which served as a vinery, my lord gazed with mortification and envy on grapes twice as fine as his own. 'My friend,' said my lord, 'you have a jewel of a gardener; let me see him.' The gardener was called—the single gardener—a simple looking young man under thirty. 'Accept my compliments on your flower-beds and your grapes,' said my lord, 'and tell me if you can why your flowers are so much brighter than mine, and your grapes so much finer. You have studied horticulture profoundly.' 'Please your lordship,' said the man, 'I have not had the advantage of much education; I been't no scholar, but as to the flowers and the vines, the secret as to training them just come to me, you see, by chance.' 'By chance? Explain.' 'Well, my lord, three years ago, master sent me to Lunnon on business of his'n, and it came on to rain, and I took shelter in the mews, you see, and there were two gentlemen taking shelter too: and they were talking about charcoal, and one said it had done a deal of good in many cases of sickness, and especially in the first stage of the cholera; and I took a note on my mind of that, because we'd had the cholera in our village the year afore, and I guessed the two gentlemen were doctors. And one of the gentlemen went on to say that charcoal had a special good effect upon all vegetable life, and told a story of a vine-dresser in Germany, I think, who had made a very sickly, poor vineyard one of the best in all those parts, simply by charcoal dressings. So I naturally pricked up my ears at that, for our vines were in so bad a way that master thought of doing away with them altogether. Well, before I tried the charcoal on my plants, I went to our nurseryman, who has a deal of book learning, and I asked him if he had ever heard of charcoal dressing being good for vines, and he said he had read in a book that it was so, but he had never tried it. He lent me the book, and I tried the charcoal in the way the book told me to try it, and that's how the grapes and the flower-beds came to please you, my lord. It was a lucky chance that I ever heard those gentlemen talking in the mews, please your lordship.'

"'Chance happens to all,' answered the peer sententiously, 'but to turn chance to account is the gift of but few.'

"His lordship returned home, gazed gloomily on the hues of his vast parterres; he visited his vineries and scowled at the clusters; he summoned his head gardener, a gentleman of the highest repute for science, and who never spoke of a cowslip except by its name in Latin. To this learned personage my lord communicated what he had heard and of the benignant effect of charcoal, and produced in proof a magnificent bunch of grapes which he had brought from the squire's.

"'My lord,' said the gardener, scarcely glancing at the grapes, 'Squire ——'s gardener must be a poor ignorant creature to fancy he has discovered a secret in what is so very well known to every professed horticulturist. Prof. Liebig, my lord, has treated of the good effect of charcoal dressing to vines especially, and it is to be explained on these chemical principles'—therewith the wise man entered into a profound dissertation, of which his lordship did not understand a word.

"'Well, then,' said the peer, cutting short the harangue, 'since you know so well that charcoal is good for vines and flowers, have you ever tried it on mine?'

"'I can't say I have; it did not chance to come into my head.'

"'Nay,' replied the peer, 'chance put it into your head, but thought never took it out of your head.'"

The lesson is plain. Science will not make the roses bloom, or fill the barns with plenty, unless its possessor has the discretion, the knowledge of details, the methodical habit of attending to little things on time in daily management. These must have been learned and have become a part of himself as much as the science, aye more, if he would achieve success in agriculture. Get all the science you can, but measure your acquisitions by the standard of utility, not display, and do not forget that the measure of our life's success depends greatly on our ability to have thought take out of our heads the ideas which are opportune, have fitness to the time, the place, and the work we have to perform.

EVOLUTION IN FARMING.

BY J. H. PEABODY.

[Presented at the Rochester Institute February 4, 1886.]

I have read of remains of statuary found deep below the earth's surface, of Roman causeways and roads, covered by the deposit of ages; have seen the deep black soil of the western prairies, the infinitesimal growth of vegetable matter through countless ages; have been down deep in the coal beds of Pennsylvania; have endeavored to understand the geological theory of deeply buried rock strata, enclosing the fossil remains of gigantic reptiles, and asked wonderingly, when was all this done? The great forces of nature have been, and are, at work around us all the time. The bare coral rocks are being slowly covered by a soil that shall be food for vegetable life. The centuries have been rolled back as a scroll, and man seems to stand the great central figure, gazing at the boundless ocean of knowledge yet to be explored.

With Nature's slow evolutions have his intelligence and knowledge kept pace? We think so, and will endeavor to confine this paper to the subject —Evolution in farming—premising with the remark that art, commerce, navigation, and agriculture are so closely related that it is hard to treat of the progress of either separately.

An attempt to describe agriculture with prehistoric man is simply speculation. It is difficult also to find data in regard to it in later history. The poet made his heroes all warriors and his heroines of the sensual kind. It seems to have been the original occupation of mankind when not at war. Joseph, the son of a farmer and successful stock man, made his greatest success in a corner on corn, but unlike our modern speculators, unloaded at cost when the poor cried for bread. David's record as a farmer is mostly confined to an account of the "set to" with the lion and the bear. Elisha was called by Elijah from plowing with twelve yokes of oxen, but was obliged to cook one of his teams to get dinner for the men. Cincinnatus' name goes into history as an agriculturist, as it seemed wonderful that a great man knew enough to plow.

Cromwell, I believe, *must* have been a good farmer, but no doubt would have remained one of Grey's "Gems of purest ray serene," had not religious zeal and great ability brought him to the front in another capacity. Viewed in a more serious light, agriculture, being a peaceful calling, has been like the springs that feed great rivers. It has been to the constant, regular accession of strong, healthful young blood of the country that great cities and manufacturing towns have depended largely for the brain and nerve force to stand the mental strain of professional and business life, and, as God has raised men up for great emergencies, so will He, in the future, allow the farmer to take his place among the great ones of the earth, if he will make himself competent and worthy. Through all the vicissitudes of time, the great change has been going on. I have not attempted to enter into particulars, on account of the time, but if one will trace back the origin of different varieties of fruit, grasses, grain and flowers, of domestic animals and fowls, and varied types of each class, of home surroundings and agricultural implements, he will discover the magnitude of my subject. A book might be written on the plow. No better indicator of a country's advancement is needed than its plow, and the knowledge of its use. I always calculate I have a good workman if he knows how to thoroughly rig up a plow for all occasions. Evolution in another form is trenching on our domain. Chemistry imitates all the products that seem desirable. Do you want raspberry, strawberry, pine apple, or orange extracts? The chemist steps behind the soda fountain, and will mix you something that is better, apparently, than the fruit itself would make. Do you want butter? He will evolve it for you. Do you want honey? He can make it from glucose, or feed that to the bees and they will make it. I understand that eggs are made by scientific methods, but class it as a canard, with the wooden nutmeg scandal. There is evolution in cheese, but we prefer the old fashioned kind that was *driven* to market, over the lignum vitæ skim milk variety, that has done so much injury to the dairy interests.

The impetus given by the application of steam to the industries has made itself felt in our calling. Printing has preserved the crystalized wisdom of the past. Invention has lessened the labor of the farm, and to-day it is to the man of *intelligence*, more than of brawny muscle, that we are to look for good farming. The last fifty years have shown the greatest advance. In horticulture great strides have been made. A large variety of vegetables are cultivated and used as food that were then unknown. Hybridizing in tree, plant, bulb and flower, natural selection and survival of the fittest have given us delicious fruits and healthful food, and canning, evaporating and preserving have kept them the year round. Some one has duplicated Harvey's discovery of circulation by tilling the soil. Specialists are studying insect life. Breeding of *improved* animals has increased. Pomology, pisciculture, forestry, irrigation, agricultural chemistry, in fact, all of the industries connected with agriculture are being made the subject of investigation by learned men, and it is to be hoped that our Government will give it recognition by assigning it a cabinet position. Low prices and competition are demanding new methods. Dairymen are eliminating unworthy animals, and "looking into the churn." Horsemen ask for a record of performance. Capital is draining the fields and brains *fertilizing them.* The school, college, grange, press and institute are contributing their aid to the farmer of to-day, and let it not be said of us, as of Jerusalem, "But ye would not." The most important question to us now is not so much one of machinery as increased fertility and more thorough cultivation.

We revere the memory and cherish the virtues of the pioneers of fifty years ago, who toiled with the spinning wheel, flax brake, hand rake, wooden mold-board plow, sickle, scythe, cradle and ax, but cannot be satisfied with their flints for matches, tallow dips, sanded floors, home-spun clothing, and simple methods of farming. They are gone, with the Walker line of stages and the red packet canal boat. We live in a different age. Insect enemies, climatic changes, competition, all require us to be on the alert. For us ships are loading with the products of other nations. Immense trains go thundering across the continent, bearing the fruits of the soil. Electricity gives the signals around the world, and is being harnessed to suit the needs of agriculture. Light and darkness, heat and cold, storm and sunshine, ice and steam, wind and water, man's reasoning powers and physical capacity are to pay tribute to God's infinite wisdom, to whom belongs the earth and the fullness thereof.

Mr. Ball: Much of the drudgery of farm life can be saved by thought.

Let us think more, work less and accomplish more. I mean this not for those who farm for fun but for those who live by farming. It is a pity that more of the thinking cannot be done by those who are practical farmers rather than by those who spend all their lives in theorizing.

Dr. Wilson: Doubtless the improvements have been great, but are we wiser as to farming than our fathers? Considering their surroundings and conditions I think to farm in the times of our fathers required as much brain as now.

Mr. Van Hoosen: I agree with the paper. When I came here with oxen and other old-fashioned equipments we had less time for institutes and improvements than now. Some say our machines cost as much as doing things by hand, but they do it better.

Mrs. A. E. Collins: One cause of evolution has been overlooked. People say, keep the boys on the farm. Is not a better way to bring city ability, culture and thought to the farm and renew the city by sending the fresh blood of the country to manage their great affairs?

Mr. Willits: As Dr. Wilson says, the progress is not so great as appears. Crops were rotated in the time of Virgil and evolution in agriculture has been less marked than in other industries. Why? Because progress in agriculture is necessarily limited. We have to plow now as then. You can travel now 100 miles where Virgil went 10, but you can't produce ten times as much grain. In shops you find one man skilful in one thing. At that he works all the time. On the farm it is not so. You can't have the same degree of skilled labor. The farmer has to work at one thing to-day, another to-morrow. But there are compensations. You don't get ten times as much wheat as before but you get about the same price, and for that price you get ten times as much of manufactured products. While a manufacturer may make a fortune in five years he may lose all in one. The farmer cannot make so rapidly or lose all at a stroke.

Mr. Ball: I differ. This statement needs a grain of allowance. I think there has been as much of an evolution in farming as in other industries. The professor and I were boys together, and we followed or swung the old cradle. Now we can get on a reaper and carry an umbrella, and do much more. Those old needs and practices have passed away by evolution or improvement. If there is a limit to improvement on the farm, then the work of the Agricultural College is a waste of means.

President Willits: I speak relatively. You cannot put twice as much work on an acre of land and reap twice as much. This can be done in manufacturing by a system of skilled labor. There is evolution, and I rejoice in it, but it is because *wheat cannot* be produced much cheaper than it is, and has been, that its price remains where it is.

Mr. Van Hoosen: Cannot one man make more wheat now than he could?

President Willits: Of course, if he has more land. You must put the same labor on more land or else lie idle part of the time.

Mr. Wm. Ball: Mr. Willits talks only of wheat. Now, while a man prepares for wheat he also prepares for the crop that follows. Our system is not now haphazard but works together, and one thing prepares for another. Agriculture advances parallel with other advancement, and they are mutually inter-dependent.

Rev. W. G. Roberts: There have been gains and improvement, but with these there have been some losses. I remember when a farmer who raised 40 bushels of wheat was a great man. It took 10 to 20 men to harvest a crop and it brought them together socially and in friendly competition. By these improvements two men will reap and store 20 acres of wheat. The Chatauquan tells of a machine in California drawn by 20 mules and managed by 4 men which harvests, threshes, and bags 36 acres of wheat in one day.

Mr. Newberry: We used to dig and hoe around stumps, to-day we blow them out with dynamite. I doubt if there is a limit to evolution in agriculture. We used to raise 15 bushels of wheat and 30 of oats, to-day we raise 50 to 80 bushels of oats. As to division of labor, it is involved in the question of coöperative farming. A man who makes a sewing machine by himself cannot have division of labor. If he has capital to employ many men he can. So in farming; one man by himself has to do everything. If he can buy an immense farm and employ many men he can divide his men and have each one confined to one thing.

Prof. Carpenter: Relatively the increase in farming crops, or in what one man can do is less than in mechanic arts. Say production has increased 100 per cent and may increase still more, yet how much more can the individual do? Perhaps he can plow 50 per cent more. Perhaps he can reap 20 times as much. Whereas in mechanics how is it? In cloth making is it 20 times only? It is nearer 1,000 times. In agriculture such a gain cannot be, for one reason your machines are only in use a little while at a time and the interest on cost goes on all the time. So you have to make a greater gain in using machines to make it worth while.

Mr. Van Hoosen: We used, as farmers, to do all our own manufacturing, making cloth, soap, etc., now we have divided it all up and so realize division of labor.

STYLE IN FARMING.

BY PROF. L. H. BAILEY, JR.

[Read before Institutes at Grass Lake and Quincy.]

We must foster every advantage which shall increase the farmer's influence. We must make the farm pay in two ways rather than in one. It is not enough that we demand influence. The first necessity in the demand is the desire to demand. We do not want preferment until we want it. The desire must be individual, sincere. We often clamor because our neighbors clamor. We want a mouse-colored mare because Smith has one. We want more farmers in Congress because it is the fashion to want them. The farm is not so isolated from the heart of fashion that it receives none of its impluse. Desire once alive, we must measure its consequences as if its fulfillment were in our own hands. Many of us would be miserable if all our prayers were answered. Our desire once trimmed and tempered, we must make ourselves worthy of it. As a rule, all men find their true level as do the waters of the sea. The ebb and the flow of influence and position are not haphazard. Our station is for the most part, if not entirely, just where it deserves to be. "The world owes me a living," says one, and he folds his hands. "But you must dun her for it," says the other as he clutches his spade.

The farmer is coming to the front. It is because he deserves it. It is because his aspirations are higher. But he cannot lift himself by his bootstraps. To-morrow the world will not recognize him more than it does to-day unless he has made advancement. The secret power of the mower and the reaper is this: It gives us more leisure for the development of the mind and the heart. If they fail of this their mission is a curse; let us return to the scythe and sickle. We do not need improved machinery and better stock so much as we need to know the possibilities of what we have. We need better school houses and pleasanter homes. If you will put it on a plane of dollars and cents, we must advertise. Here is a secret which we have not learned. We need to profit by the example of the merchant who adorns his windows and who insists that people must know that he has opened a new case of calico. If we demand influence and recognition we must let the world know what we have and what we are. Make it recognize you whether it would or not. The farmer must advertise himself as well as his cabbages. But we must generally resort to stratagem. We fail to catch the butterfly if we chase its irregular flight over the meadow, but the still hunt beside a thistle brings us a captive. We must not say to the Goddess of Liberty, "I demand representation," but we must invite her to sit in our vineyard and to eat our stuffed turkey. In other words, we must attract men, we must aim at style in farming. Herein lies the greatest need of our agriculture.

I rode over the Green Mountains. There were farm houses deserted and great farms returning to nature. The bleak homesteads stared at me. "Happy were the young men and women who escaped this desolation for the city," I thought: "Surely the decimation of these farms is not due to poor soil or commercial conditions, but to unattractive homes." A decrepit schoolhouse yawned on a bare and dusty road-side. The place itself told me why the seats were whittled and why the scholars never got beyond the "rule o' three." I did not blame them for preferring to trap woodchucks in the ledges. If I found a home adorned within and without, I usually found young people anxious to settle near the homestead; I found kindly sentiments and courteous manners.

I visited the fruit markets of a great city. Fruit at the same quality sold for far different prices, but that which sold the best bore a neat label with a picture of an attractive residence. It came from "James Lee, Beech Grove Farm." When afterwards I visited the little village near which this farm lay, I found both the farm and its proprietor to be the most popular in the neighborhood. If I asked why, I was told that "Mr. Lee has a beautiful farm and a nice family." When I visited his farm I found that his success was no mystery. The goddess of position and influence sat in his front yard. I knew the man by his premises. He advertised. A farm near an eastern city is popular and prosperous because it is attractive. A half acre of embellished lawn is more profitable to its proprietor than a dozen cows.

Our sons leave the farm and we blame the college or the school. We should as often blame the home surroundings. The man never lived who was educated too much for the farm. America ought to become the rural queen of the world, and the coming farmer must recognize this fact or go to the wall. It is one of the signs of the times. Pioneer days give place to days of relaxation, too often to days of actual decay. Then comes the sturdy and studious improvement and adornment, attended by the rapid elevation of the farmer and his calling. This last stage has become a part of the life of New England, it has spread itself over many of the beautiful hills and valleys of New York, and Michigan must feel its influence. I was surprised at a recent gathering of New England farmers to hear a spirited commendation of all efforts towards rural adornment, and that, too, for the sake of the pure adornment itself.

Landscape gardening is not planting a fine tree or making a gravel walk; a picture is not a canvas or a paint-brush. The most important part of landscape gardening lies under a man's hat. Two men view the same landscape: one sees a half dozen trees which will make ten cords of stovewood; the other sees a picture. Poetry, music, sculpture, painting, landscape gardening, are essentially the same and yet entirely unlike. They exist in the mind as the ideals of beauty,—beauty of expression, not of form. So far they are alike. They differ in the manner of communication. Poetry is communicated in words, music in sound, sculpture in the expression of form painting in combinations of form and colors on canvas, and landscape gardening, which combines much of the ideal of them all, endeavors to express itself in the arrangement of natural objects. Landscape gardening, therefore, becomes the most real of the ideal. There must be an appreciation in the mind before any picture or any landscapes can give us pleasure. "Everything the individual sees without him corresponds to his state of mind," says Emerson. The artist and the landscape gardener care not so much for the exact form of the landscape, or the kinds of objects which enliven it, as for its expression, the impression it conveys to the beholder. If the scene is gloomy, why is it gloomy? If gay, why is it gay? Victor Hugo, in his last written utterances, recognized this vital truth: "Form to the sculptor is all and yet nothing. It is nothing without mind; with the idea it is everything.

As we should expect, there have been in vogue two methods of dealing with nature in reference to ornamental gardening. She has been imitated and interpreted. Here lies an important difference with we must grasp. It is the difference between success and failure. Yonder field is a pleasant landscape; in the vale is a brook, winding its way through banks of ferns and thorns, while beyond are clumps of prickly ash, red with clustered berries and half hiding the crest of a knoll upon which the maples are bedecking themselves in autumn colors. The imitator is a literalist. The scene pleases him, and he endeavors to reproduce it exactly upon his grounds. "He holds the mirror up to nature." He must have the brook, the ferns and the thorns, he must build his knoll and plant his prickly ashes and his maples. The interpreter is an economist—he feels the force of the stoic's adage: "How many things there are which Diogenes can do without." He studies the gay scene before him, he reads its expression, he notices the cut and the colors of nature's frock. He finds that the expression does not depend upon the brook or the bank, or the ashes; he has learned that the scene is gay because of bright colors and no deep shadows. Then he need build no knolls, need dig no brooks, need not even plant the ashes and the maples, for the other trees may do as well. So, with Emerson, the landscape gardener comes to "value the expression of nature and not nature itself," to "give the gloom of gloom and the sunshine of sunshine."

We have now mastered the first and the greatest difficulty in landscape gardening; in fact, in all fine art. But if we would ornament correctly we must understand more than this. We must understand something of the laws of harmony and contrast in color, laws of form and of perspective. You tell me that I aim too high, that we cannot concentrate nature in the door-yard. We cannot aim too high if we carry sufficient ballast. I do not expect that anyone here will apply in detail all that I say to you. But if we do not know what perfection is we cannot know what imperfection is. The longer the ladder the higher I can climb. "Hitch your wagon to a star," said Emerson.

Our next difficulty is to contract nature into the space of the front yard without crushing her bonnet. A young man visited a famous garden; he was disappointed. He saw no great trees overladen with flowers and perfume, no magnificent fountains, no birds of paradise. He sat down quite out of patience. Presently he began to admire the long and enchanting views in this direction, and that he saw sheep and cows within the borders of the garden. He expressed surprise to the gardener that the garden was so very large and that the cattle did not browse the plants. The gardener laughed. Here I will let you into a secret, a secret which is a vital principle in landscape gardening: The landscape gardener always aims to deceive the beholder. A truthful deception is an evidence of skill. Small gardens which look like large ones are always cheapest and best. We must let nature build hills and valleys and rivers. Burke wrote: "Designs that are vast only by their dimensions are always the sign of a common and low imagination. No work of art can be great but as it deceives. To be otherwise is the prerogative of nature only." Discard the prevalent notion that to ornament successfully demands profuse expenditure of money. The farmer's yard demands no fountains, no statues, no expensive plants, no rows of beer bottles about the flower-beds. The farmer of all others can court simple nature to his purpose. It is not strange that keen enjoyment ceased when the old couple moved from the old house into the new. I have seen as many attractive premises about old log houses as I ever nave about our modern buildings. The narrow winding path, the wild gooseberries and hazel in the fence-row or scattered over the yard, the honeysuckle and roses that clambered over the doorway, the great gnarled trees and the picturesque well-sweep, all combined to form a fairer rural picture than scarcely we behold to-day. There mothers and daughters grew up with a keen but untaught sympathy with nature. There our thoughts revert whenever again pure nature claims our reflections. About the log house centers the choicest poetry of rural life. You know why it is. When we build our new houses we somehow conceive the notion that we have outgrown nature. We must take straight walks, we must plant our trees and shrubs in rows or in corresponding clumps, and then we must trim our evergreens—not prune them—we must trim them into absurd shapes and then endeavor to admire the idols we have made! We try to force nature into a band-box and laugh conceitedly if we imagine that we succeed.

"Insult not nature with absurd expense,
Nor spoil her simple charms by vain pretense;
Weight well the subject, be with caution bold,
Profuse of genius, not profuse of gold."

I speak of the natural style of landscape gardening. There is another and an older style of ornamentation which is known as the artificial or geometrical. This latter style is adapted to cities where space is limited and all the surroundings are geometric and formal. In this style we make our walks and drives straight and we shear our evergreens. It is this style of ornament which springs up first in a new country. The settler tires of his irregular surroundings and almost unavoidably casts his premises into regular figures. It is curious, also, that his grounds, if he pay any attention to ornament, will likely be a faint echo of the surrounding scenery. If the scenery in his neighborhood is rocky and precipitious he will most likely desire steep walks and piles of rocks. In fact the distinctive characters of three peculiar countries have been impressed upon the artificial method of laying out grounds, so that we speak of three schools of geometric gardening. The Italian school is characterized by steep flights of stone steps and massive walls in keeping with the broken character of the country. The French school builds long and broad avenues, while the Dutch school lays the foundations of ornament in long and straight canals and low, grassy terraces. The natural style of ornament has also received different interpretations. It originated in England with a refined and rural-loving people, and has spread wherever rural taste is exalted. With the advent of natural gardening, all terraces and walls and fountains were destroyed, and no ornament, save what nature chose to grant in an open field, was introduced about residence. This was Kent's school. It was long ago superseded by truer methods. The nearest approach to this school at present appears in our bare and bleak farm premises. The bareness of Kent's school prepared the way for a revolution in ornamention, and the Picturesque school appeared. Now everything must be rough and uncouth in form—banks steep and broken, old and decayed trees. The Picturesque had its day, people tired of artificial wilderness, and Repton's school was ushered in. This took the good qualities of Kent and the Picturesque and combined them to suit individual circumstances. As it took different form upon different premises, it required more skill in its management than did the old methods. But there was one radical error in the teaching of Repton; he advised the planting of trees and other plants in thick clumps where they were to grow unmolested. The weak were soon crowded out by the strong, the most delicate and often the most beautiful could not exist. During the early part of this century choice plants were introduced in great numbers from foreign countries, and they could not be displayed to advantage in the heterogeneous massing of Repton's method. Hence arose in England the so-called Gardenesque school, which, while it retained the leading features inaugurated by Repton, scattered the plants over the lawn those of similar sizes and shapes usually in the same or contiguous clumps.

We find ourselves living in a fortunate age. Old methods and stereotyped rules have fallen, chiefly because they have been put into practice. Our ornamentation should be preëminently selective; we should select the best ideas wherever they may be found. We learn from the history of the art that it is unsafe to follow fashion in ornamenting a home. Fashion may be tolerated in dress or in manners, where a change can be made to suit the whim, but in the permanent exterior adornment of a home we should beware of vagaries. Fashion has cut amusing frolics of late in the colors of residences. The old fashion or custom of painting houses a glaring white has given way to the squaw-like fashion of tricking out in incongruous red, pea-green and squash-pie colors. We look for a speedy change of sentiment in this direction, and hope to see the neutral and less expensive drabs and browns, which are never incongruous with themselves or their surroundings, come into general favor. But these are less permanent, and therefore less serious, fashions than those which have to do with the selection of trees and the laying out of grounds. Fashion which pleases to-day may disgust to-morrow. The worst part of the freeze is the thaw.

Let us discuss a few fundamental principles of artistic but inexpensive adornment. We must get our pleasantest prospects from our commonest places, from the windows of the sitting-room and the dining room. A little thoughtfulness in the placing of our residence will often add a constant blessing. I visited a friend on the pleasant slopes of the Green Mountains. There was not a pleasant prospect from any of the windows of the residence, yet from the barn-yard a noble mountain whose indistinct summit was wreathed with fitful garlands of cloud stood boldly before the observer. That farm would have been worth ten per cent more if that mountain had been framed in a window. Appropriate to yourself trees of nature's planting, build your residence near them. They are to-day what your own planting will be twenty or fifty years hence. We are to apt to think that a sandy knoll and a "good well o' water" are the only requisites to a desirable site for a residence. Our residences are often too near the highway. A remove of four or five rods is none too much for convenience and pleasure. We must have lawn. All attempts at ornament are well nigh folly without one. Might as well try to paint a picture without a canvas, or to build a house of paint and shingles, as to construct an attractive residence without a lawn. The requisites for a good lawn are the requisites for good corn, a fertile and thoroughly subdued soil. You cannot make a lawn by tickling the ground with a stick. Prepare the ground thoroughly, even if it requires two years to accomplish it, sow the seed very thick, mow the grass as often as it reaches three or four inches in height, top-dress it in the fall, and enjoy it as long as you live. Do not grade every thing to a dead level or to a continuous slope. Simply correct the little irregularities of the surface. Do not build terraces. Grading is expensive. The natural undulations of a verdant surface are more expressive than trees or flowers. The undulating sweep of the prairies is grand beyond expression. A flat surface is rarely beautiful. By a singular optical illusion it usually appears to be concave. If our grounds appear to the best advantage they must look larger than they really are. We must aim to increase an appearance of extent. A verdant and unbroken lawn must again be our first requisite. The objects which appear to be farthest away are those which possess the least number of colors. Distant hills are enveloped in a continuous haze of blue. The remotest objects in a picture possess the fewest colors. A tree upon a continuous lawn appears to be a little farther off than one at the same distance which stands among flower beds, and drooping trees whose trunks are hidden commonly appear to be a little more distant than those with exposed trunks. These illusions are of course more apparent to a stranger who has not learned the actual distance to the objects. We should plant our trees in such a manner as to form long views towards certain objects from our windows or porch. The narrower the views the longer they will look. I stand on the railroad and see the rails converge and converge until they meet away in the distance which appears like miles when it may be less than one. These slender views are vistas, "linked sweetness long drawn out." If there is a good landscape in your neighborhood, make it a part of your premises. Bring in the clump of trees on your neighbor's hill. Bring in the spire from the village church. Bring in the ravine and the thicket by the roadside. Here is a case of legitimate theft. Make every attractive object visible from your windows. Cut out the trees that hide them, or if they stand out bare and unadorned, plant trees which partially conceal them. In other words frame them and hang them as pictures in your garden. The green sward will form the bottom of the frame, the sky the top, the trees the sides. Never lay open the whole of a scene or it will look bare. Moreover, we always enjoy an object the most when we have but little of it. We always deceive ourselves with the fancy that a half hidden object is larger and finer than it really is. This whole matter is a simple one: it consists simply in the selection of our objects and then in planting or cutting out trees. To be sure our trees must correspond to the objects beyond them. If the object is a low and round-topped hill, plant round-headed trees ; if it is a spire mix in a few—a very few—Lombardy poplars. A weeping willow is in taste by a brook or pond, but it is out of place near an ordinary building. Lombardy poplars, the most ill-used of all trees, are to be recommended for a distant hill, or in very small numbers near a high and long building or about a church with a spire, but they are out of place in most yards, especially when planted in abundance. If our premises are not large enough to allow the planting of trees, we can use shrubs in a similar manner.

If we would expose glimpses of attractive objects, we must hide unattractive ones. If Smith's barn stands in front of your window, plant trees or vines to hide the most undesirable parts of it. If it stands squarely across the road from you, and if your house is near the highway, persuade him either to move it, or to paint it, and move his barnyard behind it.

The value of trees is seldom fully appreciated. Much of the common estimation concerning them is nothing more than sentiment. There are two common extremes of sentiment which are always opposed to rural beauty. The one extreme has to do with the immediate neighborhood of the residence, the other with more distant views of landscape.

It is certainly a common fault with country homes where any attempt is made toward ornament, that too many trees and bushes are allowed to grow. It is perfectly proper, indeed highly necessary, that in the first days and years of ornamenting a barren home, one should plant thickly of a variety of trees and shrubs. There should be small groups of spruces and deciduous trees of the rapid growing sorts, which will soon afford shelter and privacy. But it is none the less important that those clumps should be thinned just as fast as the individual trees begin to crowd each other. To be sure, one loves the trees which he has planted and nourished, but it must be borne in mind that sentiment should never stand in the way of beauty and utility. I do not like the hackneyed advice which urges us to plant ornamental trees at such distances as will be proper for them to occupy twenty years hence. Such advice is discouraging; we must live in large part for the pressing present. Moreover, twenty years hence is but a point of time, and it does not pay to forego the pleasure of nineteen years in order to enjoy the perfection of the twentieth.

What I always recommend to owners of unadorned places, is to plant thickly; get an immediate effect. And immediately thereupon I urge the injunction, strongly underlined, *do not neglect to thin out as soon as the trees begin to crowd.* One symmetrical and vigorous tree is worth three one-sided, stunted ones. Clumps of trees soon grow into tangled thickets, the delight of mosquitos, moulds, and vermin. They shut out sun and health, and shut one in from enchanting glimpses of distant views. The attractive clump has become an unsightly tangle, and soon all the trees will have become so lop-sided that one cannot be removed without laying bare an unsightly side of its neighbor. This is no exaggeration. The most difficult matter to press home to most people, in the way of ornament, is the fact that there should be constant and systematic thinning. It is a mistake to suppose that the surroundings of a home should be fixed. The universal law of change applies to the private grounds, as well as to the orchard or garden.

Not long since I visited a worthy farmer who desired my advice in regard to the improvement of his front yard. I looked it over, and advised him to remove a great Norway spruce, a balsam fir, an apple tree, a large chestnut, three smaller Norways, a large red cedar, a fringe tree, and several bushes. He discussed the trees *seriatim*. The great spruce he could never spare, because it was the first one set in the township; ditto with the fir; the apple tree bore good fruit; the horse-chestnut was the largest specimen in the neighborhood; the three small Norways were thrifty and attractive; the red cedar had been "backed in" in an early day from the wood at a great expense of muscle; the fringe tree cost him a dôllar, and the bushes were all attractive when in flower; therefore he could spare none of them. I could not improve his yard; and when he must look at the evening sky to note signs of to-morrow's weather, and when his wife must know who it is that is passing along the highway, they must either go some rods away from the house or scrooch under the trees. An attractive house on a distant hill is entirely hidden; in fact, there is no great outside world from the windows of that residence.

This is all radically wrong. The landscape gardener is often upbraided for his so-called impractical notions, his "fine theories of beauty," but woe to the gardener if he ever entertains notions so much at variance with laws of happiness and health, as does he who hibernates in a prison of tangled trees. No, rather have an open field with the fresh verdure of the greensward and the crisp play of winds, and an over-abundance of sunlight, than a house hidden in gloomy foliage. But let us have the golden mean. Keep the front of the house open to the world, and never allow a tree to hide a desirable view. Last spring I moved into a new house. From the front porch I could see nothing but an ordinary grove, although but a few rods beyond it were fine college buildings with their constant play of life and frolic. I cut many trees from that grove, none to its detriment either, and now as I sit at my dinner-table I can see through the grove to an attractive view beyond. This vista may be "impractical" as the common expression goes, but I am confident that I can relish my meal better than I could if I were shut up to my own dining-room and the bit of gravel path which lies in front of my window.

Now it is singular that these same people who would cling tenaciously to every old tree about the house, would often mercilessly sacrifice every beautiful great tree in a distant landscape. Rural landscapes are pre-eminently beautiful when there are drooping elms and rotund maples, dotted here and there over little eminences in pastures, in cornfields, and along highways. He is a reckless tenant who would rob nature of these isolated beauties for the sake of the stove-wood they contain. In rocky New England, where the farmers can not covet every foot of land, the grand old trees are picturesque. In our western country it is not always so. It requires some judgment, to be sure, to know when to cut a tree and when to let it alone, but it is judgment, nevertheless, which pays the effort it costs.

Trees and bushes never appear to better advantage than when seen in natural clumps. But to interpret an attractive natural clump is one of the most difficult problems in ornamental gardening. It is almost impossible for an inexperienced person to plant trees in nature's regular irregularity. He will get them in rows, in squares, in a long and irregular belt, or in an even-bordered clump. The finest natural groups are those which possess bold curves of large trees and recesses or bays of smaller ones. In such groups the large trees heighten the boldness and the small ones heighten the retirement. Then, to construct a group, draw an irregular outline, with deep bays and large, rounded projections, and plant the largest and most rapid growing plants near the border of the projections and the smallest ones near the borders of the recesses. The interior of the clump should be made up of the largest plants also. Upon the immediate borders of the group it is customary to plant low bushes to give a desirable taper from the greensward to the body of the group. The most difficult part of this whole operation will be to plant the trees in such a manner that they will appear not to have been planted. "Throw up a handful of peas and plant a tree wherever a pea falls," is a gardener's rule. Some years since a clump was set at the College by an intoxicated man, and he set the trees in exact rows in two directions.

Our grounds should be cut up as little as possible by walks and drives. The more continuous the lawn the larger it will look, and the more easily it can be cared for. There is a prevalent notion that walks must be crooked, and we occasionally see extravagant forms of such vagaries. In a certain eastern city is a fine residence with a cork-screw walk leading from the front gate to the residence, but if the person is not intoxicated by the appearance he can walk in a bee-line through the center of the cork-screw! Landscape gardening never demands extravagant forms. A walk should never appear to go where it does not go. A direct and gently curved path from one side or both sides of the premises is the most desirable. The carriage drive should enter at one side and approach the side of the residence, reach the kitchen door and veer off towards the barn. Directly in front of the house there should be a well kept lawn of small extent, with enough shrubbery to intercept the gaze of passers-by, but not enough to conceal desirable views. It is pleasanter to secure side views of the highway than direct front views, and especially so if the residence is close to the highway. The flower-beds should be at one side of the residence, nearest the common windows, and in but partial view from the highway. A front yard full of flowers possesses the same fault as a person with an over-gaudy dress.

For ordinary ornamental purposes, common flowers and native shrubs are the best. We know them. The craze for exotics simply because they are exotics is drawing to a close. The craze has been of great benefit, because it has taught us the value of native plants by instituting a means of comparison. A friend valued his visit to Italy because it taught him to appreciate the sunsets of Michigan. Many exotics are beautiful and vigorous everywhere, but many more are not so. They demand of the farmer too great an expenditure of time and money. Our woods and fence-rows are nurseries. All our shrubs are worthy of cultivation. We do not know how to propagate them all to advantage, but we can transplant them. They should be taken up early in the fall with a liberal amount of earth, and stored for a couple of months in a warm cellar or cool greenhouse. The plants will then make roots. They should be placed in a colder place, as out of doors on the south side of a building with a protection of mulch. In the spring plant them and they should all live. Give them some culture. Always plant the smallest leaved and prettiest plants near the residence. Pines are too coarse for the immediate vicinity of the house. Their proper place is in a windbreak, or rather distant screen.

Much of our territory is wasted between highway fences. We are over generous with our roads. Their sides are bare, weedy, unsightly, useless. In most places highways two rods wide are preferable to those which are four; we could then have better and pleasanter roads. We need to concentrate our efforts. Still we pride ourselves on our highways. We have mistaken land for roads. We have sacrificed comfort to boast of generosity. "In thy rags we see thy vanity," they said to Diogenes. But we possess the means of making our extremity a blessing. The judicious planting of trees and shrubs would render our highways attractive. Trees in rows along the sides of straight and level highways are not out of taste, teaching to the contrary notwithstanding. But we need variety. With a change of surface we should have a change of verdure. Bushes in irregular and natural clumps are pre-eminently in keeping in low places and especially along water courses. Our native bushes should not be lost to common knowledge. Here is an opportunity to rescue nature along our roadsides. Clumps of tall trees appear to best advantage on eminences. They exaggerate the unevenness of the surface. Here is a subject which demands a lecture, provided the lecture would arouse energy.

The whole subject of rural ornamentation is one which demands study and attention, rather than lavish expenditures. It is not beyond the farmer's grasp. Successful farming must combine with itself enough style to render it attractive. Like all style it may fall into errors of gaudiness, impropriety or even ridiculousness; nevertheless, to ignore all ornament is to strip our agriculture of every pleasing garment. Agriculture cannot make much advancement so long as it is characterized by bareness. The boys and girls will leave us for more attractive pursuits. We must grapple with the problem. The first requisite is to screw our courage up to the sticking point.

LIGHT SOILS—HOW THEY CAN BE WORKED TO THE BEST ADVANTAGE.

BY DAVID GEDDES, OF SWAN CREEK.

[Read before the Farmers' Institute in East Saginaw, February 12, 1886.]

Agriculture has for its chief aim profitably to avail itself of the powerful forces which nature places at our disposal for the increase of animal and vegetable life, and that increase is based upon the employment of certain agents which are essential to these forms of life. It will not be amiss, then, to state briefly what these agents are, and to this end it is necessary to analyze the products of our soils, and the simplest way to do this is to burn them, and we find a portion of the plant goes off in the shape of gases, and the remainder is left in the shape of ashes. It will then be seen that our plant has been composed of parts or elements, which are respectively called the organic or inorganic parts of the plant. That which burned away was the organic part, and that which remained—the ashes—the inorganic part. Chemistry teaches us that these parts are composed of certain elements, fourteen in number, and that these same elements exist in animal and vegetable life. The organized part of the plant consists of four gases, oxygen, nitrogen, carbon and hydrogen; the inorganic part, of potash, soda, lime, magnesia, oxides of iron and manganese, chlorine, phosphoric acid, sulphuric acid and silica. Now, this is the starting point. Experiment shows that plant life, for its development, must always find and set in motion these elements, but that it combines them in an infinity of proportions and in a variety of structures. The gaseous or organic part is found to be nine times the weight of the inorganic part, or the ash. Now, the organic part is composed of carbon, oxygen, hydrogen and nitrogen, all of which, if we except the latter, are received by the plant from the atmosphere, and the remaining one-tenth, or organic, part of its support is received from the soil; so that in reality all the fertility that can be restored to the soil by hand of man is but insignificant compared with what is supplied from the great storehouse of nature—the atmosphere; yet, insignificant as this inorganic element is, it is absolutely necessary to the life and growth of a plant, so much so that if any of it be absent (any of the ten elements, potash, lime, etc.), the plant cannot be produced to perfection. Now, the absence of any of these, or any undue portion of one or the other, would make a barren soil, and hence a soil may be rich in one element and poor in another, and consequently a soil may be only partially poor. It will be found that our worn-out lands in Michigan are so by continual cropping with some particular class of plants, such as wheat, oats and timothy hay, and these lands are only poor in the elements which these take more largely from the soil than any other, that is phosphoric acid and potash. I by no means say that this is all that is wanting, but these are the principal elements. It will always be found that the relative productiveness of different soils is intimately connected either with an abundance or a deficiency of phosphoric acid and potash. Root crops especially have ashes rich in potash, and the failure of roots on lands which formerly produced good crops, I can safely say, is due to the exhaustion of available alkalies. But supplying one element does not necessarily make the soil grow good crops. In a great number of cases an analysis of soil would be of great service. It is an easy matter to restore fertility if we know what elements of plant growth are absent or lacking in availability, and what manure contains these elements in the cheapest and most available form. I do not know whether our farmers would or could conveniently analyze their soil, but certainly it would pay. I have known an endless amount of money spent on salt, lime, and other manures, without any benefit, simply because the soil did not require these ingredients. The general cause of the sterility of soils is either the absence of certain constituents indispensable for the growth of plants, or the presence of others which exert an injurious or poisonous action; and hence an analysis is often necessary in order to find out what injurious element preponderates, and what to apply in order to neutralize it. On the supposition, then, that we know exactly what food our soil is lacking in, how shall we best restore it? And this gets us right into the midst of the controversy on fertility and nitrogen—whether the latter is supplied by the atmosphere totally or partially, or whether it has been supplied to the soil in the shape of nitrogenous manures. This brings us again to barnyard manures and artificial manures, and the office humus plays in fertility; and this again leads to the question: Can the fertility of a sandy soil be restored by any other means than by returning to the soil the straw and grain upon which they grew, or in other words, by barnyard manure? and if there is any other way, is it available to our farmers? And is it profitable?

Admitting that barnyard manure would have kept up the fertility of the soil if applied in sufficient quantities, the question arises, will artificial manures answer the same purpose without the aid of barnyard manure? The experience of Mr. John Prout, a prominent English farmer for the last twenty years, says it can, for he has made farming on a sandy soil for this lengh of time profitable without the application of barnyard manure. He started twenty years ago with 450 acres of poor land, and has used nothing but artificial manures, and the result is he has made business pay, and has doubled the value of his estate in this time. He sells all the wheat and straw at auction, and buys artificial manures. Mr. Prout's system has shown conclusively that the great supply of nitrogen, which was supposed to come from manure, applied to the soil, is, in reality, largely taken from the atmosphere. By careful experiments made by Dr. Voelker, of this soil, and the chemical analysis of the crops taken off it, it was found that Mr. Prout was only supplying thirty-eight and a half pounds of nitrogen year by year, and seventy-one pounds was exported from the farm in the shape of grain, etc. The question now arises, where did Mr. Prout obtain this nitrogen? It was not from the soil, nor was it supplied in the manure, and the inference is it came from the atmosphere; if this is the case, the fertilization of worn-out soils resolves itself into simply this: Supply the inorganic or mineral element and the rest comes from the atmosphere. Now, it is well known that barnyard manure contains for its bulk comparatively a small proportion of essential salts (fourteen pounds in a ton), such as potash and phosphoric acid. Good wood ashes have twenty times more potash and ten times more phosphoric acid than a given quantity of barnyard manure. But, of course, the question arises again, will these substances of plant food in such a concentrated form, be equally distributed to become at once available? This is another point; and with this again comes the physical or mechanical condition of the land, which, strictly speaking, would not come under the subject in question, for it simply says restoring fertility, although I may say here, parenthetically, that I am fully persuaded that but little of our soil, in the strict sense of the word, is really worn out. A great quantity of our supposed exhausted soil has a sufficient quantity of plant food, but it is not available, owing to its physical condition; or in other words, for the want of proper drainage and thorough culture. Liebig says: "The influence of mechanical operations of agriculture upon fertility of a soil is remarkable, and often borders on the miraculous." I know land in Saginaw county which was considered sterile, which, by drainage and thorough culture, brought forth good crops. I have seen land heavily manured and rich, chemically speaking, yet by bad culture it failed in production; for this reason I have no doubt manures often receive credit due to good tillage, and I am strongly of the opinion that thorough culture, stirring the soil, is our cheapest manure. But this is not the point; the supposition is that the soil lacks the necessary elements of plant food, and the question is, how to restore its fertility. No rule can be laid down which will cover every case.

After knowing what elements the soil lacks the question arises how to obtain these most cheaply. We shall have to resort to different methods of keeping up fertility, according to what materials are cheap and what are dear. There is no royal road to enriching land. Plant food should be considered in a commercial light, and there is no doubt science has so far advanced that a commercial article should be placed on this market containing all the elements of available plant food.

Mr. John Prout finds that the commercial system of manufacturing manure in the long run is the cheapest, and that, all things considered, manure, whether made in the barnyard or in the factory, was simply produced by capital and labor. The question is whether our animals are the cheapest manufacturing machines of plant food, or whether it cannot be made cheaper than in the barnyard. It will generally depend upon circumstances and the facilities people have of procuring manure. There are only two ways that suggest themselves—either to buy manure or to plow under green crops. If manure is obtained at anything like reasonable prices, to buy is the most direct way of increasing production. Farmers living in the vicinity of cities have easy access to manure, which can often be bought very cheaply. If our cities had any sufficient system of collecting night soil, and pondrette companies were started, this would be a great source of obtaining a cheap supply of rich manure. The apatite mines of the Saginaw valley are an endless source of plant food. If it could be placed within the reach of the farmer he would want nothing else to restore his worn out sandy lands. A farmer should look around for every available means for obtaining plant food. There are often means within his own reach which he neglects to utilize. There are but few farmers that have any means of saving their liquid manure, which is allowed to drain off and stand in cesspools around the barnyard. This liquid manure contains more plant food—essential salts—than the solid in the ratio of 9 to 7, and hence it can be seen what a loss is sustained on every farm. Then these ashes, the inorganic part of the plant. How many save these and do not trade them off for a bar of soap? To a great many sandy soils ashes have in reality all the elements that are wanting—potash, phosphoric acid and lime. Indeed, the action of ashes on potash plants, such as potatoes, corn, turnips, etc., is wonderful. I have experimented for years on a sandy soil with ashes for these crops, and I have found the results in the yield corresponding to what should be expected from their chemical composition. In a country like Michigan ashes can be obtained cheaply, and if the theory of others is correct that the nitrogen of plants is mainly derived from the atmosphere, ashes may be looked upon as containing all the essential elements the plant receives from the soil.

Plowing in green crops is the only remaining way left of restoring fertility to a sandy soil; but a green crop, to be of much service when plowed under as manure, must be the growth not of a worn-out sandy soil, but of soil well supplied with plant food; and green-crop manuring, to be effectual, should be subsequent to barnyard or artificial manure, and should be the second step in restoring fertility. Restoring fertility to a sandy soil any way must be a gradual process, and no one can expect to recuperate a sandy soil by one or two manurings. It is easy enough to keep up fertility of the soil by plowing under good, heavy crops of clover, buckwheat, etc., when your land is in good heart, but when it is poor is another question. Last year I saw a direct application of manure, and the plowing of green crops experimented with on a poor sandy soil, and I am fully persuaded that the loss of one crop compared with the increased production of two will amply pay for the buying of manure at a high figure. Then there is another question, whether it would not pay better to cut green crops and feed it to stock and return it to the land. There is no doubt that clover is the manurial crop that can be plowed under. The chemical effect of plowing under clover and other green crops is simply to return to the soil all the elements of plant food that the plant lived upon.

Then I say: "A good crop of clover, which has produced one heavy crop of hay, and which has been allowed to stand for seed, will add to the land a fertility for wheat which could not be attained with the heaviest practical dressing of guano." But to this I further add: "The clover must be treated so that it will produce and leave on the ground the greatest possible amount of leaf and roots, for in these two portions of the plant consist the virtue of clover." But as I said before no one's means should be relied upon by the farmer. He should study the nature of plants and his soil, and draw plant food from all sources by plowing under green crops, using commercial fertilizers, ashes, barnyard manure, (by keeping a good stock of animals) in fact everything that will make two blades of grass grow where only one grew before; experience, a knowledge of agricultural chemistry, circumstances and the intelligent application of capital and labor, should dictate to the farmer more than anything else which is the best practice to pursue in restoring fertility to a sandy soil. What would be a profitable practice to one farmer might not be to another.

Proper drainage, thorough culture, and rotation of crops can be profitably practiced by all farmers, and will make up for a great many deficiencies in plant food. A good rotation is the following, beginning with a rich clover sod. Cut the clover the last of June, and let the second crop grow until about the first of September, and manure very heavy with well rotted barnyard manure, all that can be ploughed under. After two weeks the clover will grow up through the manure, and with proper care may be plowed under in good shape. Then cultivate well until late in the fall, and the sod will be well decomposed and in good shape for a crop of beets or carrots in the spring following. Put in the seed without plowing in the spring, and by this method of culture a crop can be grown with very little trouble and will keep our sandy soil in a rich and fertile condition. By the use of clover and barnyard manure land will grow two good root crops, with a top dressing in the spring. After fall plowing the next crop should be oats or barley, well seeded with clover, about eight quarts to the acre, and then plowed under in the fall and sowed with wheat, and again seeded with clover and timothy and left for two years, and plowed down. By this process our sandy soil can be kept up as rich as any soil and be very early tilled. Beets and carrots should be sown as early as the 1st of May, and turnips from the 2nd of June to the 1st of July. Potatoes from the middle of May to the middle of June; be careful in planting your potatoes and not get too much seed in the ground or you may grow small potatoes. The great secret in growing a root crop is attending to them in proper time and in the proper way, so it may not cost any more to grow them than a potato crop, commencing to work in them as soon as they are out of the ground, and do not be afraid of getting them too thin. I sow twenty-eight inches between the rows, and cultivate with a horse. There should be no coarse or raw manure put on land for a root crop in the spring, for coarse manure will cause your roots to grow crooked and prongy.

Mr. Robert Ure: Jethro Tull held that cultivation without manure was all sufficient. In our farmers' club it is thought that a cheaper way than cultivation or manuring, and one producing equally good results, is to cover the surface between rows with cull lumber.

Dr. Kedzie: Keeping the soil covered induces capillary action. Liebig said that the farmer need only apply mineral, or as he called them, soil elements and no air elements, and that by analysis of the ash you could tell precisely the manure needed for each plant. But his theories did not work well in practice.

As to the quality of commercial manures for sale in our markets, the last legislature passed a law providing for their analysis and imposing penalties for fraud.

[The text of this law will be found in full on another page of this report.]

As to whether it is cheaper to buy commercial fertilizers or to produce the manure on the farm I take issue with Mr. Geddes. I think that in ordinary cases a man cannot afford to buy commercial manures. At the market rates for such things a ton of clover hay would be worth $12.00 a ton simply for the manure it would make.

FARMING ON LIGHT SOILS.

BY C. L. HALL OF NORVELL.

[Read before the Farmers' Institute at Grass Lake, Feb. 16, 1886.]

My experience has been mostly upon light soils, and I find that they are not store houses of fertility like the deep black soils of the west, to be drawn on at pleasure; but that each crop taken from it reduces its fertility. I find too, that it contains but very little inert plant food that can be made available by turning it up to the action of the frosts and the heat of the sun, as is the case with heavier soils, and if we expect it to produce continually we must feed it.

We must sell but little to be consumed away from the farm, as that robs the soil of so much of the elements of fertility. Then what kind of crops shall we raise and what style of farming is best adapted to this kind of soil?

In the first place, I would have every acre not in crops seeded down to clover as it is a well-known fact that there is no fertilizer so cheap as red clover, and wherever it has been raised and a rotation of crops has been practiced there has been no apparent loss of fertility. But the great difficulty upon light soils is the failure to get a good catch of clover. This failure is due mainly to two or three causes. Where seed is sown on top of the ground and left to take care of itself the spring is often so dry that the seeds never sprout and if there is moisture and shade enough for it to come up, the hot sun of a week will dry the soil below the roots and it dies. Then where the seed is sown upon freshly harrowed soil and harrowed in, the earth lies so loosely about the seed that it never germinates. This difficulty may be overcome in a measure by the use of a roller drill, the rollers passing over the ground presses it down firmly leaving a narrow hard bed for the seed, the first rain that comes washes the soil down firmly on top of the seed and it seldom fails to sprout, and being a little below the surface of the ground it is not so easily affected with early drouths.

The principal crops upon light soils should be clover, corn and rye. I find that wheat draws heavily upon light soils and does not yield as much in proportion as corn. A light soil that will produce 20 bushels of wheat per acre will produce 100 bushels of corn, while a natural wheat land in relatively as good condition will produce 30 to 35 bushels of wheat and no more corn than the light soil. Since it is doubtful if it pays to raise wheat on heavier soils, why should I raise wheat at all?

Light soils are not natural pasture lands, so I should keep but little stock on the farm through the summer; 100 sheep turned on to clover in the spring will keep down and destroy enough to fatten 200 wethers in the winter. Having no stock on the farm through the summer it gives a chance to cut plenty of hay, and after the hay is off the clover springs up again and makes an abundance of fall feed.

In August, buy cattle or sheep suitable for fattening, (the number to be governed by the size of your hay-mow or corn-crib) and turn on to your clover early enough to prevent its seeding, as I do not think it pays to cut clover seed. This stock should make a vigorous growth by fall when they should be taken up and made to consume the straw, cornstalks, hay and coarse grain through the winter and be fat ready for the spring market, leaving nearly all that grew on the farm converted into a fertilizer that supplies the wants of all kinds of crops.

With this mode of farming the principal crop of grain should be corn. We should therefore give it the most attention. It should be planted upon clover sod, all the manure that has been made the previous winter should be hauled out and spread upon the corn ground, and if 20, 30, or 40 acres is planted, let the manure cover the entire ground, spreading the best upon the poorest places. Before plowing, sow plaster at the rate of 75 pounds per acre. Plow not to exceed six inches deep, harrow thoroughly, work four feet each way and plant three kernels in a hill. Begin cultivating before the corn is up, with a spring-tooth cultivator made for the purpose, with pole and handles, cultivate until the corn is two or three inches high, then change to a large tooth cultivator and cultivate deep until harvest, going over the last time with a fine tooth to level the ground. As soon as the corn is cut, or not later than the last of August if the corn is not cut, cultivate and sow to rye and drag it in. This will make good pasture in the fall and early spring. If the land is poor, seed down and cut the rye. The rye will make excellent feed for cattle when ground with corn. If the land will bear it, pasture until the rye begins to head out and then plow it under for fallow; sow to wheat and seed down again, two crops is enough for light soils. The soil needs to be shaded from the hot rays of the sun through the long summer months. But it needs no rest. Keep seeded to clover, sow plenty of plaster, and utilize every load of manure that is made on the farm and it is possible to get a living off a sandy soil.

Pres. Willits: Some years ago I bought an old stock farm with barns and yards that covered ten acres. Just back of the barn in sod was a three acre calf lot. I removed the barns and plowed that area and raised such a crop of corn that you would not believe me if I should tell of it. The soil was light, sandy, and the crops held for a while and then through a strip in the middle two or three rods wide the crop failed, the corn was yellow. There was no good sub soil. Now what can you do with such a strip ?

Mr. Hitchcock of Sharon: Some men speak as though they would sell sandy land for $50 and pay $80 for clay, and there they would miss it. The trouble is they don't understand the nature of sandy soil. A productive soil contains all the elements of plant growth, and if the farmer by growing successive crops of wheat or otherwise, takes from these elements an undue proportion of some of them so as to destroy the equilibrium he destroys the fertility of his soil.

As to plaster, fifty pounds per acre is enough, because it is all that a season's rainfall can dissolve. As to leaching of sandy soils it is trifling and the chief advantage of top dressing is due to its value as a mulch added to its value as a manure.

Prof. Johnson: All clay soils contain a percentage of sand and all sandy soils contain a percentage of clay, and the lightest sands have the least clay in them. A loamy soil has about 60 to 70 per cent of clay and 30 to 40 per cent of sand. We increase the fertility of sands by making them more retentive. We can winter more stock on light soils than we can summer. Thorough culture of light soil makes it more retentive of moisture and fertilizers. Soil analysis can do little in testing the value of soils for agriculture, as there is such a great variety in the conditions of fertility. Let each study his own soil and its possibilities.

Pres. Willits: Do I understand the gentleman that the value of a sand depends upon its proportion of clay and that clay would be the best manure for sand?

Prof. Johnson: Clay would be a valuable dressing for a sandy soil if it could be well mixed with it.

Mr. Stark: Prof. J., I understand, says that fertility depends on the proportion of clay in a soil. Now suppose a man with a sandy farm has a clay bank, should he haul the clay bank on to his farm?

Prof. Johnson: That depends on the quality of each.

Mr. Platt: Mr. Ball said that clover on sand is shorter, more nutritious and better than the long growth on clay soils. If he will sow twice the seed on his clay he will get three times the crop he could on sand and of as good quality. I have two acres of sand on my farm and have to put three times the manure on that spot and get less crops in everything, unless it be of corn. Wheat looks well on that piece but doesn't thresh out well. I am in favor of clay or clay loam.

Mr. Van Hooten, of Sharon: I have always been a farmer. In testing we say the proof of the pudding is chewing the string. So the test in farming is experience. In Ontario county, New York State, I bought twenty-seven acres. It had six acres of plastering sand (no quick sand) and some brick clay and some blue clay. I seeded the whole and it came up well on the sand and not so well on the clay. I found that in the sand the roots went down eighteen inches and made a crop while in clay there was not enough vegetable mould to grow the clover and it died. How to bring the clay to grow the crop that the sand did, either of wheat or clover was the question. I tried mixing the soils. There was a muck bed near and I mixed muck with sand and put them on the clay and put clay and muck on the sand and plowed and cultivated and got bigger crops on the sandy ground than on the clay. The clover roots on the sand penetrated deeper than on the clay and that was the reason of its excellence.

Some one said if he had a sandy farm he would sell it for $50 and buy clay for $80. I differ with him. Before he can make his clay farm produce what his sand farm would, I can raise enough on the sand farm to pay for the clay farm. I am a Dutchman.

President Willits asked how to make one part of a field equal another. se a fertilizer; charcoal, vegetable mould from the forest, leaves with lime, hes, plaster to make seed catch, and sow the large clover, because its roots will penetrate the farthest, and hence do more good than the small clover.

Wm. Ball, Hamburg: I agree with last speaker. I think he will make his farm pay. I was born on a heavy clay farm in New York State and reared on one in Washtenaw county, part of which was heavy clay and am now on a farm having all kinds of soil and I like them all. It is true that you could buy a clay farm with the produce from a sand while you were getting a clay farm ready to produce. It is also true that a clay farm has more strength in it, but it is harder to get it out. Larger crops of wheat can be raised from clay well tilled than from sand well tilled, and of corn from sand well tilled than from clay well tilled, and of barley from a mixed loam. As a balance sheet of the whole, my experience has been that the finest improvements are found on lighter soils. Clays holds out longer because they have more originally and give it out more slowly. As to the clover. On very strong land the heavy crop does fall and get wet and sour. The suggestion to sow more seed is the true remedy.

SOIL EXHAUSTION.

BY H. A. LADD.

[Read before the Farmers' Institute at Grass Lake, February 16, 1886.

The soil is a deep subject, and requires more than a pen to dig to the bottom of it. But I will confine myself to the soils with which I am most familiar, such as your farms around here are composed of, gravelly and sandy soils. Heavy soils lose fertility, but they have plenty left, while a poor, sandy soil doesn't have to lose much to become worthless.

The general opinion, as to why these soils are so poor, is that the goodness leaches out of them, and the waters that soak into the earth carry it down beyond the reach of plants. Now, as China is a very rich country, and as I have been unable to discover any of this fertility any deeper than it has been plowed, I have come to the conclusion that, if it does leach down, it must go clear through and come out on the other side. Rather than accept that explanation, I have abandoned the theory entirely. If the fertility does leach down, it is in such small quantities that we need not try to prevent it. I can find but three ways that vegetable humus, or fertilizing matter, can escape from the soil. One is by crops removed; but with a proper rotation and mixed husbandry, this need not impoverish the soil. Another is, by surface wash. Some idea of the importance of this cause of waste can be gained when we think that, through the countless ages since creation, these waters have been descending in the form of rain, washing the soluble portions of the hills into the hollows, and carrying it down unnumbered rivers, to be lost in the sea, while the waters returned again for more. Scientific authorities estimate that the Mississippi daily pours into the sea the nitrogen equivalents of two thousand tons of nitrate of potassium, the most valuable of plant foods; while an acre of ground does not average over two tons. One thousand acres daily, or three hundred and sixty-five thousand yearly, washed down only one of these great rivers.

Now, the class of soils that are the most injured by washing, are the hard, gravelly soils; while the sand and loose gravels, which are poorer, as a rule, do not suffer so much from this cause. Probably the most of you who own such soils have noticed that barnyard manure, plowed under, will almost entirely disappear after one or two seasons; while on clayey soils it may be seen for years. Now, as I am satisfied that it doesn't leach out, and being plowed under, it can't wash out, I conclude it must burn up. All vegetable matter, at a proper degree of temperature and moisture, rapidly decomposes. Science teaches us that decomposition is a slow process of combustion; that a stick of wood that rots down in the woods gives off as much heat as though burned. Sand, in a dry, hot day, attains a degree of heat probably double that of clayey soils. (I have not tested it with the thermometer, but with my bare feet when a boy.) In examining the condition of manure that was plowed down for corn last spring, and turned back for oats this fall, I find some looked as though it had been burned in a charcoal pit. The heat had been so great during the drouth that it had actually turned it black. You can readily see what a waste there must have been if there had not been some growing crop to utilize the gases driven off, and to protect it from the burning rays of the sun. There is no question in my mind but that this power of sand to absorb heat is the cause of its poverty in the state of nature. Is it any wonder, then, that the settler found this section of Michigan almost a desert (where the Indians burned it bare every time it got dry enough), and thought they had a good catch of clover if they got one plant to grow every four feet. Yet these same soils, the past season produced an average of nearly twenty bushels of wheat per acre, a yield greater than any State in the Union can boast of, an achievement of which we are proud, but which does not satisfy us, as we can do still better.

Ask these old farmers who have helped to create this change, what has caused these light soils to come to the front rank as farming lands. Without an exception they all say "clover and plaster," some add, "and sheep." We can all see the effect of this treatment. Some seem to think that the clover with its tap root goes down after that fertility that has leached out and that the plaster draws moisture from the air to nourish it in times of drouth. I believe it does bring up mineral foods from the subsoil, but if I believed in leaching I would not dare sow clover for fear the fertility would all go down the holes that the roots made, thereby rendering it worthless for short-rooted plants like wheat. And as for plaster drawing moisture from the air it is rather absurd, when if put in a barrel in the barn it will dry it up till it falls to pieces. It is the only thing that was ever known to dry out a salt barrel.

Clover seems to possess more good points than any other plant. One of these is the tap-root already mentioned. This is the great universal practical subsoil plow. Another is its mechanical effect on the soil; it acts as a dam to the waters, causing them to settle into the ground where they fall, leaving their plant food instead of carrying it away and washing the goodness out of the soil. It also, by its thick growth of top, acts as a mulch, prevents evaporation, cools the ground, stops this burning up of plant food in sandy soils, and on account of its being cooler than other plants, condenses more dew laden with fertilizing matter.

Why is it that plaster, which by chemical analysis, contains almost no fertilizing matter, is able to produce forty times its own weight, or one ton of hay from fifty pounds? Why, although not able to draw moisture does it destroy the effect of drouth and sometimes keep clover green and growing a week later than clover not so treated. The primary effect seems to be to combine with the gases escaping from the soil changing them from an inert to an available form.

This being taken up by the plant produces a greatly increased growth of top, which in turn produces the indirect but most important effect. By this increased growth of top it keeps the sun from heating the ground, retains more of the rains that fall and condenses more dew.

By its use we not only save our own soils from loss, but we can draw down and condense the gases that have escaped from the fields of our neighbors who do not use plaster. This theory, it seems to me, explains the reason why we cannot see any benefit on rich soils. The plant will attain sufficient growth without any aid, and therefore the primary effect would be greatly lessened and the secondary effect wholly lost.

At the present time there are other agents employed to keep the soil from losing fertility. One of these is salt, which has the merit of being cheap and certainly helps keep the soil moist and cool, thereby reducing its tendency to loss by carbonizing. Is it better to plow under a crop of grass worth ten dollars per acre for hay or cure it and feed it to stock? By the latter plan we can return four-fifths of it to the land as manure, which, with the roots later in the season is worth more than the roots and tops turned under early in the season. I tried the former plan once, but shall not again.

Shall we buy phosphates or complete manures, costing 1½ to 1¾ cents per pound, and which are only plant food to raise wheat which is only worth 1⅓ cents per pound?

There are some chemical fertilizers that give promise of good results, but have not been put to the test of practical application on our farms. Next to clover in importance comes barnyard manure, which I think is greatly under valued, the farmers, as a class, not making half what they might, and letting half go to waste in their yards, while of what they do draw to the fields, not over half is ever appropriated by growing plants, thus reducing the supply to one-eighth of what it should be. Still another way to increase the value of our fields is by thorough cultivation. A summer fallow, if kept thoroughly worked, will keep moist and draw dews, thereby gaining in richness. A good rule, if you can follow it, is to never let a crust form on a tilled field during the summer months.

There is no doubt in my mind but that a system of tiles on our poorest hill sides would be of great benefit, but probably not enough to pay for the tile. They would draw the water down through the soil, keep the surface from washing, and also act to increase the moisture in time of drouth. Cole's "New Agriculture" proves that this theory is correct, but does not prove that it is profitable. I have become so impressed with the importance and correctness of the theory that excessive heat is the cause of the universal poverty of dry sandy soils, that I recommend anything that will keep the surface cool, such as all kinds of mulch. Straw, which is of small value as a manure, may exert an influence equal to phosphate if applied to the surface. I would never plow under manure on such soils unless I planted some crop to utilize it before it could be burned up. Although acknowledging that poor sand is the poorest soil, I do claim that rich sand is the most valuable of any soil on the face of the earth, especially in wet or cold seasons.

In connection with the subject of manures I would like to ask the opinion of the farmers present if it is good economy to go to great expense and labor to compost our manures when the heat generated and lost is just what our corn crop needs in its early stages of growth. I got this scientific doctrine down one cold winter and kept it down till spring, but sweat it out during the summer at the little end of a manure fork. Believing that the time has come when we can succeed only by raising the crops with the least possible amount of manual labor, it seems necessary that we should know what we are doing, and why we do it, that we may work in harmony and not in opposition to the wonderful unchangeable laws of nature. Let us, while trying to fill our pockets, not do it by robbing our lands but by clothing them, and assisting nature to beautify the earth.

Mr. Stark, of Webster: I never lived on very light or very heavy soil, but have a happy medium, a gravel, though it is often called a light soil. I can endorse the emphasis of the paper as to benefits of mulch. My experience is, if you can cover a soil it will recuperate and become rich. When a plank is removed after lying some time you are surprised at the richness of the spot. I think clover is chiefly valuable as a shade. Light soils may be very good, are easy to work, but they won't stand drouth.

Wm. Ball: As to filtration, any farmer who has a manure pile that has lain for years on the lightest soil can test the question by digging a little way under the pile. The soil soon loses all discoloration. The water filtrates through and the sediment is left. The subsoil has little to do with leaching. A good subsoil has qualities of its own irrespective of leaching, and is also a favorable index of the character of the surface soil. As to the comparative merits of light or heavy soils, where do we find the best buildings—on clay or light soil?—on light soils. Clay holds water in drouth, but also at other times to the detriment of the crop, and light soils produce value at less cost than heavy soils. I like the paper, particularly the part about clover, manure, and plaster. I often wondered why plaster has less effect now than 20 years ago. It is because our soils are better fed now and are less hungry. Cut a fine crop of clover on light soil and you have excellent hay. Cut the same area on clay and you may have twice the weight, but it is of stalks and juice and not leaves, nor will it produce more beef than the one ton of better hay from the light soil.

RED CLOVER.

BY PROF. W. J. BEAL.

[Read at Institutes at Hudsonville, St. Louis and Okemos.]

Although in a general way this is a plant familiar to all our farmers, its great importance to the agriculture of our country demands that we keep trying to learn still more of its habits and peculiarities. The expression, "To live in clover," has become proverbial, and is another way of designating a good living. With a field of clover knee high, or up to the eyes, means fat cattle and swine and bunchy sheep. Some one styles the plant as "The red plumed commander-in-chief of the manurial forces."

Red clover was known and prized over 2,000 years ago by the Greeks and Romans, but it can hardly be said to have been cultivated, even in the simplest way, till used in England about 1633—253 years ago, or 44 years before the cultivation of perennial rye grass, and nearly 100 years before that of any other of the true grasses.

For a long time it was propagated by scattering the seed in the chaff, as it accumulated at the stack or barn.

Plants have their kinships—their rich relatives and their poor connections, as well as people, or any of our wild or domestic animals. The clovers belong to a royal family of plants known as

THE LEGUMINOSÆ, OR PULSE FAMILY.

The fruit of such plants is usually in the form of a pod or legume, as a type of which, we have that of the pea and bean. For the technical definition of the family, you will consult your botany. The Pulse Family contains, at the lowest estimate, 6,500 species, and is excelled in numbers by one other only, viz.: the Compositæ, which includes asters, golden rods, sunflowers and dandelions.

Plants of the pulse family are widely distributed in every climate and in all kinds of soil. They vary in size from the little pussy clover to the giant locust trees of Brazil. We comprehend only a small portion of their uses and wealth when noticing those species which are cultivated in the United States. Red, white, mammoth and alsike clovers, Lucerne or Alfalfa and Sainfoin fill a place which could not well be supplied in our pastures and meadows, while peas and beans are scarcely of more importance than the peanut which would be missed in our country groceries and on the corners of the street, as well as by the people of Africa and the tropical islands. The Pulse Family is the most wonderful of all the families of plants in the enormous numbers and variety of its useful products. Its wealth is fairly bewildering. It contains barks of great use for tanning leather, many delicious perfumes, valuable medicines, tough fibres useful for cords, ropes or coarse cloth. It abounds in durable timber and in ornamental and fragrant woods. For gums it beats the world and supplies also many valuable coloring materials. It is well suplied with ornamental species.

In the scientific description of a plant which has been so long and so well known, there is scarcely any chance for originality. The following comes about as near the mark as any and is mainly from HOOKER'S FLORA OF THE BRITISH ISLANDS.

TRIFOLIUM, L. TREFOIL, CLOVER.

Herbs, usually low. *Leaves* digitality, rarely pinnately 3 foliolate; stipels adnate to the petiole. *Flowers* capitate or spiked, rarely solitary, red, purple or white, rarely yellow; bracts small or 0, sometimes forming a toothed involucre. *Calyx teeth* 5, subequal. *Petals* persistent; wings longer than the keel, the claws of both adnate to the staminal tube. *Upper stamens* free; all the filaments or 5 of them dilated at the tip: anthers uniform. *Style* filiform, stigmas oblique or dorsal; ovules few. *Pod* small, indehiscent, 1–4 seeded, nearly enclosed in the calyx. Found in the north, temperate and warm regions, rare in southern; species, 150.

T. PRATENSE, L. RED CLOVER. BROAD LEAVED CLOVER. COMMON CLOVER. MEADOW TREFOIL.

More or less pubescent, leaflets oblong, stipules membranous, free portion oppressed to the petiole, heads terminal, sessile globose, at length ovoid, subtended by opposite leaves with much dilated stipules, calyx-teeth slender setaceous, erect or spreading in fruit, the lowest longest.

Pastures, roadsides, etc., both wild and cultivated; ascending to 1,900 feet in the Highlands [of Great Britain]; flowers from May to September. Annual, biennial, or perennial. *Stems* 6—24 inches, solid or fistular, robust or slender. *Leaflets* $\frac{1}{2}$—2 inches, often marked with a white spot or lunal band, finely toothed; stipules often 1—1$\frac{1}{2}$ inches, with long setaceous points. *Heads* $\frac{1}{2}$—1$\frac{1}{2}$ inches diameter, pink, purple, or dirty white. *Calyx-tube* with a two-lipped contraction in the throat, strongly nerved; teeth not exceeding the petals, very slender, unequal. *Pod* opening by the top falling off. Found in Europe, North Africa, Siberia, Western Asia to India; introduced in North America certainly before the Revolution.

Red clover usually has a large tap root with numerous branches extending in all directions. Sometimes the tap root is short, and soon equalled by its branches. The roots rarely ever extend less than two feet below the surface, as in moist compost land, or where the surface is very rich. Where the subsoil is at all open and inclined to be dry it is not unusual for the roots of clover to reach down six feet or more below the surface; however, the main bulk of the roots are usually within a foot of the surface. Various experiments and careful estimates have shown that fully one half the weight of a clover plant is below ground in the form of roots.

Concerning the stems and leaves I shall speak more in detail in the paragraph which treats of variation of the plant.

The flower is irregular, papilianaceous, and its structure rather difficult to understand without considerable study of specimens or good illustrations.

The nectar is secreted by small glands at the base, on the inside of the tube formed by the cohesion of the nine inferior filaments, and accumulates around the base of the ovary. In the center of the flower is the pistil, the style of which curves upwards, carrying the stigma a little beyond the anthers. The tenth stamen is free and for most of its length is turned to one side, making it quite easy for the long tongue of a bee to reach the nectar.

In the words of Mühler, "If now a bee inserts its proboscis beneath the vexillum, while it clings with its forelegs on to the alæ (which are coherent with the carina), resting its middle and hind legs on a lower part of the inflorescence, the carina and alæ are drawn downwards, and the stigmas and anthers are thrust up against the under side of the bee's head; the stigma, standing highest, receives the pollen brought by the bee, and instantly afterwards the anthers dust the bee with fresh pollen. Cross-fertilization is thus insured; self-fertilization may take place as the bee draws back its head, but is probably neutralized and superseded by the immediately preceding cross-fertilization. In order to reach the honey in this way (to the bottom of the tube) an insect must possess a proboscis at least nine to ten m. m. long. The pollen is accessible to all insects which can press down the carina, and such insects, whether they reach the nectar or not, will perform cross-fertilization."

In a former report for 1882, which is now scarce and hard to get, I reported various experiments of my students, together with some made by myself to show that

BUMBLE BEES ARE A GREAT AID IN FERTILIZING THE FLOWER OF RED CLOVER.

The following single experiment will serve as an example. Two fine bunches of the first crop of clover apparently alike, were covered with mosquito netting. No insects were seen about either, except what are mentioned below:

On June 29th, a bumble bee was placed inside of one netting and seen to work on the flowers.

On July 10th, two more bumble bees were introduced and seen to work, and on July 12th more bumble bees were introduced, and were seen to work on the flowers.

On July 31st, fifty ripe heads were selected from each plant, and the seeds carefully shelled and counted. The fifty heads on the plant where the bumble bees were excluded yielded seeds as follows:

40	heads	yielded		0
6	"	"	one each	6
1	"	"		2
1	"	"		3
1	"	"		5
1	"	"		9
Total				25

The fifty heads on the plant where bumble bees were inserted and seen to work under the netting, yielded seeds as follows:

25	heads	yielded		0
2	"	"	one each	2
5	"	"	two each	10
3	"	"	three each	9
3	"	"	four each	12
3	"	"	five each	15
1	"	"	seven	7
1	"	"	eight	8
1	"	"	nine	9
1	"	"	ten	10
1	"	"	twelve	12
Total				94

In the above experiment, both lots of heads were covered alike with netting, that no one could say the difference in yield of seed was due to the fact that one lot was covered and the other not covered.

Above, it will be observed that where the bees were seen to work on the flowers the yield of seeds was nearly four times that where the bees were kept away. But perhaps the two plants would not have yielded the same number of seeds had they been treated in every way precisely alike. In reply to this suggestion, I can offer the following, which shows that in six examples selected at random, only one was found in which the yield of seeds was nearly twice the number found in the heads containing the fewest seeds.

On September 13, 1882, I selected of the second crop of red clover, five plants within ten feet of each other, which seemed to be much alike. They had not been covered in any way. The seeds from fifty good heads of each plant were shelled out with the following results: 1,260; 1,275; 1,460; 1,485; 1,820. It will be seen that fifty heads from plant number five contained only about one-third more seeds than fifty heads from plant number one.

In another place fifty heads selected from one plant yielded 2,290 seeds, nearly twice as many as plant number one in the first lot. Mr. Darwin covered one hundred flower heads of red clover by a net and not a single seed was produced, while one hundred heads growing outside yielded by careful estimate 2,720 seeds. He says: "It is at least certain that bumble-bees are the chief fertilizers of the common red clover."

It may not be out of place to say here that experiments with white clover, show that visits of honey bees increase the yield of seeds enormously. In one case eight protected heads yielded five seeds, eight visited by bees yielded 236 seeds. This is an increase of over 47 fold in favor of the bees.

A large number of carefully conducted experiments made by many persons on a great variety of plants show results quite as remarkable as those above cited. Here the bees and bumble-bees not only make use of a waste product, but help the plants as well. Most botanists now believe that odor and showy flowers are advertisements for attracting insects, and that nectar and surplus pollen are the wages to compensate insects for services rendered in fertilizing the flowers. If this be the case, should not the farmer seek to encourage meadow mice which make the nest sought by bumble-bees in which to rear their young? The bumble-bees, at least, should be encouraged.

THE SLEEP OF LEAVES.

This can in no way be compared to the sleep of animals, but refers to the fact that the leaves of clover take different positions at night from those assumed during the day time. This difference in position is caused by turgescence in the "pulvinus" which is the name applied to a mass of small cells of a pale color found in a certain portion of the leaf stalk.

Experiments show that leaves kept open or spread apart, contain more dew in the morning and hence become cooler than those which approach each other. The leaves crowd together or "sleep" for the same purpose that pigs crowd together on a cold night, viz: to keep warm. It has been found that the leaves which sleep do not remain quiet during the night, but continue, without exception, to move during the whole twenty-four hours. All non-sleeping leaves are also in incessant motion, circumnutating. The sleep of plants is a mere modified form of this universal circumnutation. During a warm, dry day, leaves also assume the sleeping position which aids in checking evaporation. There are more "sleeping" plants among the *Leguminosæ* than are found in all other families put together.

A LITTLE AGRICULTURAL CHEMISTRY.

Of the thirteen elements necessary for plant growth, the farmer usually need take but little care, excepting in the supply of potassium, phosphorous, and nitrogen, and of these three nitrogen is the most precious and costly to obtain.

All agricultural plants draw much of their food from the atmosphere, and of those used by the farmer probably none are much exceeded by clover in the large proportion of nutriment thus derived. In this respect other leguminous crops are much like red clover.

"Clover seed is the best manure that a farmer can use." Clover has been called "a trap for nitrogen," as it collects and presents large quantities of combined nitrogen in a form ready to nourish growing crops.

In the words of Dr. Kedzie, "With an adequate supply of combined nitrogen all the other chemicals of agriculture become active, while a limited supply of active nitrogen correspondingly limits the action of the rest. For high farming or the raising of exceptionally large crops, the great want is an abundant and cheap supply of ammonia and the nitrates.

"An acre of good clover will make 5,000 pounds of hay, containing 282½ pounds of mineral matter or ash. In this ash will be 97½ pounds of potash, 96 pounds of lime, 34½ pounds of magnesia, and 28 pounds of phosphoric acid. The hay will also contain 108 pounds of combined nitrogen." The roots and stubble contain fully as much of these elements as the hay.

Baron J. B. Lawes found that in autumn after the last crop of clover was cut, that remaining above ground and to the depth of 27 inches, was examined:

	Pounds per acre, dry.
Stubble, etc., above ground contained	2,669
1st nine inches " "	3,017
2d " " "	272
3d " " "	191
Total	6,152

This was between three and four times as much dry matter as the residue of the barley.

In the words of Kedzie, "The clover hay, *or sod,* contains enough phosphoric acid for more than double an average crop, enough nitrogen for more than four average crops, and potash for more than six average crops of wheat! If any person were preaching the gospel of agriculture, he well might hold up the triple leaf of the red clover as the symbol of a trinity of blessing to the farmer, furnishing for his cereal crops, from otherwise inadequate sources, a sufficient supply of potassium, phosphorous, and nitrogen. If I were designing an emblematic seal of our national agriculture, I would make the central figure the clover leaf. For the farmer it is the most effective trap for nitrogen within his reach."

The late George Geddes of New York, said: "It has been demonstrated beyond a doubt that clover and plaster are by far the cheapest manures that can be had for our lands—so much cheaper than barnyard manure that the mere loading of and spreading costs more than the plaster and clover. Plow under the clover on the more distant fields when it is at full growth. A very considerable part of the cultivated land of Onondaga county has never had any other manuring than this clover and gypsum, and its fertility is not diminishing. The cost per acre is $2.32."

The following as to the use and management of red clover is gleaned from *Harris' Talks on Manures:* "Clover is, unquestionably, the great renovating crop of American agriculture. A crop of clover equal to two tons of hay, when plowed under, will furnish more ammonia to the soil than twenty tons of straw-made manure, fresh and wet, or twelve tons of ordinary barnyard manure.

"I prefer to make the clover into hay and feed to animals, as they seldom take out more than from five to ten per cent of all the nitrogen furnished in the food, and less still of mineral matter. If you plow it under you are sure of it. There is no loss. In feeding it out you may lose more or less from leaching and injurious fermentation. As things *are* on many farms, it is perhaps best to plow under the clover for manure at once. As things *ought* to be, it is a most wasteful practice.

"Clover is good for wheat; plaster is good for clover. The roots run deep, drink large amounts of water, and can live on very weak food. The clover takes up this food and concentrates it. The clover does not create the plant food, it merely saves it. To improve sandy land, instead of plowing the clover under or feeding it off, mow the crop just as it commences to blossom and let the clover lie. There would be no loss of fertilizing by evaporation, and the clover-hay acts as a mulch. Mow the second crop about the first week in August."

The following computation of the relative money value of one ton of various foods for producing manure is from the experiment of Mr. Lawes:

Cotton seed meal	$27.86
Linseed cake	19.72
Beans	17.73
Wheat bran	14.59
Clover hay	9.64
Indian meal	6.63
Meadow hay	6.43
Oat straw	2.90
Potatoes	1.50
Turnips	.86

All agricultural plants draw most of their food from the atmosphere directly or indirectly, and of those used none are exceeded by clover in the large proportion of nutriment thus derived.

If the stubble and roots contain more than half of the manurial value of red clover, and if live stock only appropriate from five to ten per cent of the nitrogen, and the other 90 to 95 per cent goes back to the field or the dung heap, it certainly must be the best practice, as a rule, to feed red clover instead of plowing it all under.

I have not seen a more concise and valuable summary of this matter, than the one by the late Dr. Voelcker, as found in the journal of the Royal Agricultural Society of England, for 1868.

1. "A good crop of clover removes from the soil more potash, phosphoric acid, lime and other mineral matters, which enter into the composition of the ashes of our cultivated crops, than any other crop usually grown in this country."

2. "There is fully three times as much nitrogen in a crop of clover as in the average produce of the grain and straw of wheat per acre."

3. "Notwithstanding the large amount of nitrogenous matter of ash constituents of plants in the produce of an acre, clover is an excellent preparatory crop for wheat."

4. "During the growth of clover a large amount of nitrogenous matter accumulates in the soil."

5. "This accumulation, which is greatest in the surface soil, is due to decaying leaves dropped during the growth of clover, and to an abundance of roots, containing when dry from 1¾ to 2 per cent. of nitrogen."

6. "The clover roots are stronger and more numerous, and more leaves fall on the ground, when clover is grown for seed than when it is grown for

hay; in consequence more nitrogen is left after clover seed than after hay, which accounts for wheat yielding a better crop after clover seed than after hay."

7. "The development of roots being checked when the produce, in a green condition, is fed off by sheep, in all probability, leaves still less nitrogenous matter in the soil than when clover is allowed to get riper and is mown for hay; thus no doubt accounting for the observation made by practical men that notwithstanding the return of the produce in the sheep-excrements, wheat is generally stronger and yields better, after clover mown for hay, than when the clover is fed off green by sheep."

8. "The nitrogenous matters in the clover remains, on their gradual decay, are finally transformed into nitrates, thus affording a continuous source of food, on which cereal crops specially delight to grow."

9. "There is strong presumptive evidence that the nitrogen which exists in the shape of ammonia and nitric acid, and descends in these combinations with the rain which falls on the ground satisfies, under ordinary circumstances, the requirements of the clover crop. This crop causes a large accumulation of nitrogenous matters, which are gradually changed in the soil into nitrates. The atmosphere thus furnishes nitrogenous food to the succeeding wheat indirectly, and so to say, gratis."

10. "Clover not only provides abundance of nitrogenous food, but delivers this food in a readily available power (as nitrates) more gradually and continuously, and with more certainty of a good result than such food can be applied to the land in the shape of nitrogenous spring top dressing."

The above conclusions should be posted up and read daily by every farmer till they are intelligibly fixed in his mind.

Owing to the great depths to which the roots penetrate the soil,—frequently six feet or more,—they help to bring up a run-down farm; they bring the valuable ingredients from a great depth and store a large part of them in the main bulk of roots near the surface, where they are available for future plant growth.

WHERE WILL RED CLOVER THRIVE?

Red clover is well adapted to many portions of the temperate regions of the earth. It likes best a soil of clay loam rich in lime, but will thrive better than Timothy and many other fine grasses where the land is sandy or gravelly. On good grass land it is usually the custom to sow Timothy with red clover, although it blossoms some three weeks later. Many prefer to sow orchard grass with clover, as they flower and are ready to cut at the same time. Timothy is well adapted to sow with the large or late clover.

Red clover is not only a general favorite in the United States from Maine and New Jersey to Iowa and Illinois, but is very valuable farther West and South.

For Kansas: Professor Shelton reports that it deserves a prominent place in the list of forage plants. In some very dry seasons, it fails almost entirely, but during the favorable seasons it flourishes abundantly, and yields more—both of hay and pasture—than is generally obtained in the East. When land is once seeded, it never runs out, as is the case in the Eastern States, but thickens and spreads continually by self-seeding. He believes that nowhere are such large crops of clover seed grown as in Kansas.

In Mississippi: Professor Phares says red clover grows most luxuriantly on all their lands with tenacious red or yellow clay subsoil, even though the soil be thin; and once set, it remains as long as the farmer desires, provided he does not mow more than twice each year, nor graze too heavily.

In Georgia: The late C. W. Howard says, "This is the most valuable herbaceous plant to the Southern farmer. It bears grazing admirably, makes excellent hay and in large quantity, and thrives on land of moderate fertility. The doubts as to whether red clover would succeed at the South have been dispelled. At the South it lasts for several years."

Red clover is valuable to enrich the land and hence to enrich the owner; it is not excelled by any forage crop as a wholesome summer pasture for swine, and some have spoken very highly of its use in winter when fed to swine in the form of hay. For soiling, a good growth of red clover is very valuable and it has often been packed into the silo to feed as ensilage in the winter.

We have ample testimony from a great variety of sources that red clover with a little gypsum and perhaps a top dressing of some other fertilizer, is one of the best ways to smother and kill out our worst weeds.

The following was furnished by special request by J. S. Woodward, now one of the editors of the *Rural New Yorker:*

"Canada thistles have long roots which store up nourishment during the latter part of summer and fall to feed the spring growth. I kill the thistles without the loss of a crop, as follows: Have the land rich, if possible, at least have it well seeded to clover and by top-dressing with plaster, ashes, or by some means get as good growth to the clover as possible. As soon as the clover is in full bloom, and here and there a thistle shows a blossom, mow and make the crop, thistles and all, into hay. After mowing, apply a little plaster to quickly start the growth of clover; you will find this to come much quicker than the thistles. As soon as the clover has a good start, from July 20th to August 5th, plow down, being careful to plow all the land and to fully cover all growth. Then roll and harrow at once, so as to cover every thistle. But few thistles will ever show themselves after this, and they will look pale and weak. When they do show, cultivate thoroughly with a cultivator having broad, sharp teeth, so as to cut every one off under ground. In two days, go over with a sharp hoe and cut off any that may have escaped the cultivator. Watch the thistles, and keep using the hoe and cultivator until freezing weather. You will see them getting scarcer and scarcer each time and looking as though they had the consumption. By plowing this field just before freezing up, you will have the land in the finest condition for a spring crop. This plan not only kills thistles, but ox-eye daisies and other weeds. It is much better than a summer-fallow, and without the loss of any crop."

PUTTING IN THE SEED.

Too little care is exercised in selecting the seed, as most of it contains more or less seeds of pernicious weeds, and especially does this caution become more and more necessary as the country becomes older. The troublesome weeds of a farm can generally be directly traced to foul seeds sown with grasses and clovers for the meadows and pastures.

In the northern portion of the United States numerous experiments seem to clearly indicate that it is best to sow seeds of red clover in spring. In some sections it is sown even before freezing ceases, but many now practice sowing just in time for the young plants to begin growth with the first early vegetation. If sown in autumn, especially late, the young plants are very likely too feeble to survive the winter. If sown at all in autumn, the date should be early enough to give plants a good start. In the warmer parts of our Union, clover is often sown in autumn or in winter. Clover seed is most generally sown where wheat and some Timothy were sown the autumn previous, though it is not unfrequently sown in spring with a thin seeding of oats or barley. It is a common practice with our best farmers to harrow the ground very lightly before sowing the clover seed. This benefits the wheat as well as favors the growth of the clover.

Where no grass seeds have been previously sown, at the West the farmer sows 6, 8, or 10, or even 12 pounds of clover seed to the acre, but at the East 20 or 30 pounds is not thought too much.

In Great Britain, which possesses a moist climate favorable to the development of grasses and clovers, it is the practice to sow much more seed than is usually sown in the United States.

There are 16,000 clover seeds to the ounce or 156,000 to the pound. In ten pounds there would be 1,560,000 seeds. In England farmers often sow seeds of grasses and clovers enough, if all grew, to produce 16,878,000 to 27,000,000 plants, which is ten to fifteen times the amount thought sufficient by our Western farmers. The Englishman seeks to get large numbers of fine, small stems instead of fewer large, coarse ones.

In various portions of our country, isolated farmers have sown clover in the spring on well prepared land without the presence of another crop, and they get a crop of grass or clover the first year. This practice needs more thought from the average farmer.

CARE OF THE YOUNG CLOVER.

It has often been shown beyond question that the young plants will be more certain to live, and will grow faster and become stouter, if not sown with a grain crop. If the wheat is thick and large, the clover is likely to suffer; if the wheat is thin and light, clover is likely to become large and crowd it.

It must not be forgotten that young clover is most generally greatly benefited by even a very light dusting with gypsum, say one-fourth to half or even a bushel to the acre. Sheep and swine must not be allowed to feed young clover, at least very long, because it may be much damaged or even killed.

Clover needs a little time to get its roots well established, and this can not be done without the aid of green tops.

Clover fails "to catch" for a great variety of reasons. The soil may be very much "run down"; or the seed is poor, sown too late, the ground too rough, not harrowed nor raked; the oats or wheat get the start and choke it out; the weather in spring is too dry, too hot; the young plants are fed too closely. The frosts of spring may kill the young plants.

WINTER KILLING AND REMEDIES.

Red clover not unfrequently "winter-kills" or "heaves out," and the dead plants in spring stick up out of the ground several inches, especially in winter when there has been a little snow on the ground and frequent alternations of freezing and thawing.

To prevent winter killing, see that the plants are well established in autumn and that they are not fed off closely. Thorough tile draining is a great benefit. A moderate amount of tops left on the ground will often be of some assistance, or a very thin mulch of straw put on *after* the ground has *just become* well frozen. An *early* mulching of straw has sometimes done more harm than good. No attempt should be made to save red clover over to a third year, as such efforts are not successful.

As spring approaches and the ground warms up, it is rather discouraging to find the clover killed out. The proprietor often plows up the ground and puts in another crop, thus leaving the land in a still worse condition for the next seeding to clover. He raises millet, or Indian corn or rye, or buys of his neighbors a supply of winter feed. In case of partial winter killing the writer cannot help thinking that too little attention has been given "to patching up" such as meadows in spring. By this is meant to harrow, re-seed, and if possible, top dress with some sort of manure.

THE BEST TIME FOR CUTTING CLOVER FOR HAY.

The following is from Prof. H. P. Armsby:

"What has been shown to be true of meadow hay in this respect applies also to clover. The earlier it is cut, the more concentrated and digestible the fodder, while as it grows older, the crude fibre increases and it becomes coarse and less easily digested. In regard to the advantages of early and frequent cuttings, the experiments do not all give such striking results as those on grass."

It is not my purpose and time will not permit giving a full account of what is already familiar to good farmers, viz: the curing of clover for hay, but I will give a brief account for your consideration of the method practiced by the Hon. L. N. Bonham, a member of the State Board of Agriculture, Oxford, Ohio.

He has long since abandoned the old method of his fathers and now puts up his clover hay in the mow the same day it is cut. The hay is far better and the labor and risk in making it are far less. He selects a bright day for starting the mower and begins as soon as the dew is off. By 11 o'clock, he cuts as much as can be hauled in between 1 and 5 o'clock. The clover is turned before dinner. By 1 o'clock it is dry enough to rake into windrows if the day is a good one. After 5 o'clock the mower cuts some for getting in the next day. His mow is quite tight and he packs the hay in snug, preferring to put wheat or straw or something on top of the hay. He wants to keep the air out and pack it well. In this way, clover put in the mow, warm and dry the day it is cut, will keep brighter and purer and sweeter than if cured longer in the field. Of course it is not dry, but quite free from external moisture.

SAVING CLOVER SEED.

The proper time to cut for seed is a difficult one to state, especially as the heads ripen unevenly. The heads should be examined, as the first ripened frequently contain few seeds, but sometimes more than the heads which blossom later.

Some farmers have observed that clover, when cut quite early, from the 5th to the 15th of June at the North, is more certain to seed well than that cut later. In some instances they report double the amount of seed from the clover which was cut early. Considering its high price, if there is any prospect of greatly increasing the yield of seeds more experiments are much needed. Some were suggested in the paragraph which treats of the agency of bumble bees in fertilizing the flowers. In England, Dr. A. Voelcker tried some different sorts of manure for this purpose with results by no means satisfactory or conclusive. Probably the efforts were made in the wrong direction, as indicated in the preceding paragraphs.

For securing the seed, red clover is ordinarily cut with a reaper which delivers the clover in small gavels. In this way the clover is moved to one side and is not damaged by the tramping of the horses. The clover is allowed to lie until it is well dried and probably black and brittle. It may need turning once or more before dry and ready to thresh or draw to the stack or the barn.

Clover seed during the harvesting will stand a good deal of abuse and not lose its vitality. During a very unfavorable season for curing, when there was much rain, I tested samples from about sixty different farms in Michigan and found they averaged 85 per cent of good seeds, rarely going as low as 75 per cent., though one lot went down to 25 per cent. Some went up to 98 per cent.

RELATIVE VALUE OF DARK COLORED AND LIGHT COLORED CLOVER SEED.

Dark colored, bright looking seeds are generally considered the best. The results obtained on testing numerous samples in different seasons indicate that there is no difference in favor of the dark seeds either in vitality or the quality of the plants which they produce. It is generally the case that all the seeds, or nearly all, from one plant resemble each other in color and size. Some plants produce yellow seeds, others produce dark ones, others produce seeds of mixed colors.

Clover is usually threshed and cleaned with a machine made for the purpose. The yield runs from less than a bushel to the acre to two bushels a fair yield, four bushels a fine yield, or even six bushels an exceptionally good yield.

VARIATION OF RED CLOVER.

The late Professor James Barkman of England (in Jour. Royal Agr. Soc., p. 446, 1866), says the American red clover is a much larger and coarser plant and more hairy than that cultivated in England, doubtless due to a longer and warmer summer.

The wild clover, as early introduced into Europe, is usually the small hairy plant that we meet with [in England], and greatly different from that described by Sinclair, which is larger and quite smooth. The Professor adds that "both when wild and when cultivated, it is perhaps as protean in form as any plant the farmer has to deal with. Some are more perennial than others; all are more or less hardy, more or less productive, and these differences have a high significance. However, it seldom happens that any particular type can be obtained pure, though the value of the seed varies just in proportion as it is so.

"There are three desiderata with regard to clover:

"1. A good sort or sorts.

"2. Pure seed of the sort.

"3. Seed from a known and suitable climate."

The Professor goes on to describe six of the leading varieties, none of which are just like those I find in Michigan.

Not long ago our seeds of red clover came from Europe, and already we have a great change in the plants.

I have for some years past studied quite carefully in different stages of growth, at different seasons, and on different soils, many hundreds of plants. I have preserved some of the plants and seeds of a few of the most striking.

There is nearly, or quite, a month's difference in the time of producing the first crop of flowers. Some plants stool out and send up many stalks; others few. On hot, dry days some plants wilt, while others show no signs of wilting. Some plants are tall and large, or slender; others are short, even where the soil seems to be uniform; some are erect, even where there is nothing to crowd them; others spread out at once, even where somewhat crowded.

The leaves and stems of some plants are densely pubescent; others are nearly smooth, and between these are all gradations. In this respect the same plant varies a little at different seasons. The stems vary much in length and number of branches and in the color. On some plants the leaves are dark green; on others light green. The leaflets often contain a light spot, which varies in shape, size, and intensity. Some are destitute of any trace of spots. Some leaves are firm and a quarter or more thicker than others; some are thin and flabby. Some leaflets are as broad as long; others are elliptical, lanceolate. The stipules vary in shape, color, and position taken. The heads of flowers vary in size and shape, and so far as seen were sessile, with an involucre of two leaves. The calyx tube and the lobes of the calyx vary in size and hardiness. The petals vary in length, direction taken, and differ in color from dirty white to pink and bright scarlet. Varying with the season, and probably with the plant, the pistils contain each from none to two, three, or even four seeds. There is a marked difference, as before observed, in the color of the seeds.

Of some plants observed, I give the following brief description: Plant No. 1 is early, stems purplish, few and small, erect, quite hairy, leaflets spotted, rather narrow, leaflets of the involucre, lance-elliptical. Plant No. 8 is late, stems few, stout, sprawling, quite smooth, purplish, leaflets rather narrow, with scarcely a trace of a spot. Plant No. 17 is very late, stems long, of medium size, spreading, green, quite hairy; leaves light green, spot inconspicuous. Plant No. 19 is a seedling of dark seed. The stems come up early, are numerous, large, tall, erect, smooth, purplish; leaflets rather broad, thick, very dark green, with no trace of spots; flowers dark colored.

THE MODEL PLANT.

I have begun a few experiments in a very small way by selecting and raising different races of red clover. This variation in red clover in our fields is a broad hint at the results which may be obtained by care and study.

For the Northern States we need a red clover which starts early, grows rapidly, has numerous erect, rather stout stems which are not large. If too woody, the stems make coarse food; if they contain too little woody matter they will not be stiff enough to stand up well. The plant should be rather hairy, as such plants usually endure hot, dry weather best. The plants should seed freely, and to aid in this, if possible, the tube of the flower should be short enough to permit honey bees to reach the nectar.

The tongue of a honey bee when stretched out is six to seven micro-millimeters in length, while the tube of the carolla of red clover is nine or ten micro-millimeters. It seems by this, there is a wide breach to be gained in growth of tongue or shortening of flower before the honey bee can sip the nectar at the bottom of the tube. The tongue must elongate one-third or the tube of the carrolla shorten one-third. The occasional visits of bees to the flowers of red clover may be accounted for by supposing they seek pollen or they seek the honey which has filled a considerable portion of the floral tube. The upper portion of this honey can be reached, even with the tongue of the ordinary honey bee. I again call your attention to what has frequently appeared in former reports and lectures of mine. To raise seed of clover which shall produce plants that are more hardy, larger, more vigorous and more prolific of seed, mix seed grown in remote localities.

CLOVER SICKNESS.

This is a term used in Great Britain to indicate a failure of the plants to thrive after they have once started. Many observations and experiments have been made and much has been written on the topic in regard to the cause and remedies. Except in a very few places in the older portions of the United States, no trouble of this nature has appeared on this side of the Atlantic. Recent investigations by Kutzleb show that clover sickness is not due to parasites, to lack of nitrogen, to lack of water, or to unfavorable physical properties of the soil, but to a deficiency of easily soluble potash, especially in the subsoil.* It is not improbable as our country grows older, that repeated crops of clover may so deprive the subsoil of the potash that clover sickness may become common.

HOVEN.

This is a term applied to cattle which have become sick and bloated after eating too heartily of clover which was fresh and wet. At such times, till the cattle have become used to the feed so as not to be greedy, they should be turned off the clover after eating for a short time.

TRIFOLIUM MEDIUM L. MAMMOTH, GIANT, OR PEA VINE CLOVER. COW-GRASS [OF ENGLAND].

The following description of the typical form as it appears in England, is mainly from

HOOKER'S FLORA.

Plant slightly hairy; leaflets oblong, obtuse, or acute; stipules herbaceous, free portion spreading; heads sub-globose, terminal, often shortly peduncled, subtended by opposite leaves; calyx-teeth setaceous, spreading in fruit, lowest, a little longest. June to September, perennial. *Stems*, straggling, flexuous, often zig-zag. *Leaflets,* 1–2 in., rather rigid, almost quite entire, ciliate. *Heads* 1–1½ in. diam. *Flowers*, ¾ in., rose-purple. *Calyx-throat* with a ring of hairs, tube 10 nerved glabrous; teeth reaching half way up the petals. *Pod,* often dehiscing longitudinally. Distributed in Europe, Siberia, Western Asia; introduced in North America.

This clover is *Trifolium medium* and so named a long time ago by Linnæus. The common name might with propriety be "medium red clover." I mention this fact because farmers have lately got in the notion of calling the early red clover "medium" clover.

Mammoth clover is quite similar in appearance to the early red clover, but it flowers later, with timothy, is very often a perennial and is adapted for permanent pasture; the stems are larger, more inclined to spread; the leaflets are narrower and often destitute of a light spot, the flowers are bright red and larger than in *Trifolium pratense* and form less compact heads.

---

* NOTE.—H. P. Armsby: Science p. 146, 1883.

The samples found at the Agricultural College and in many other places show all grades of intermediate forms. These two species seem to be freely hybridized.

At my request, my friend A. C. Glidden, of Paw Paw, Michigan, has made numerous inquiries in reference to its value in his portion of the State where it has been largely grown.

L. B. Lawrence, of Little Prairie Ronde, Cass Co., who owns a large prairie farm, has grown it for many years. He considers it less hardy than the other species; it is more liable to "heave" in the spring, and often grows so rank as to kill itself by the burden of stalk on the surface.

He thinks the roots are smaller and that it feeds on the surface, and does not work in the subsoil like the other species. He formerly pastured this clover till the first of June, when he allowed it to flower and seed, which would often come off early enough to plow for wheat. He has recently run over the field with a mower, clipping the tops about the first of June, and allowing them to remain as a mulch, while the new growth forms seed.

D. Woodman, of Paw Paw, once sowed a field in equal divisions of the two kinds, and the mammoth clover furnished double the amount of feed for pasture, as compared with the other half of the field. The season was a dry one.

The prevailing sentiment is that the mammoth clover does not make as good hay as the other species; it is often coarse and woody. Another point should not be overlooked. They all agree that the mammoth clover is much the most productive of seeds. As this is the case we may expect it will soon become more common than it is at present. Farmers will select the large kind to raise seeds to sell, and many times this seed will finally be purchased by farmers and sown, supposing it to be the early or round-leaved red clover.

In managing this crop, it should be understood that if left without pasturing or mowing in spring, there will be a small crop of seed.

"In Central New York," says Professor Roberts of Cornell University, "of late years we mow the seeded land but once, and pasture in the fall the abundant second growth. Since 1878 the clover-root beetle, *Hylastes trifolii*, Mühl, has worked upon clover to such an extent that it invariably fails the second year. This has caused us to change from a five to a four year rotation, viz., hay, corn, oats, and wheat.

Prof. Beal added some comments on the increase of insect enemies to the clover, but said that the parasitic enemies of these insects are also on the increase.

At Hudsonville the following discussion took place after the reading of the paper.

Mr. Densmore: As to plowing clover under, when should it be done, in blossom or when seed is ripe?

Prof. Johnson: In preparing for wheat, plow under early and cultivate till time to seed, so as to get the clover so decomposed that it will be in good condition to feed the young wheat. When plowed later I get less benefit.

Prof. Beal: My idea exactly. In England it has been found that plowing under clover stubble after cutting off the seed gives better results than plowing under the whole crop. As a rule it is better to feed clover off before plowing under.

Prof. Johnson: We sow timothy in the fall with wheat and in the spring when the ground is well settled, sow clover. We have little trouble on our soils (chiefly clay) in getting a good seeding. On light sandy lands it may be better to sow in the fall, though in this case the wheat is apt to be checked by excessive growth of the clover.

President Willits: I have heard a prominent cultivator assign as a reason for feeding down before plowing under, that to plow under the whole causes it to sour and leaves the soil in bad condition.

Prof. Beal: There is nothing in the souring idea. He probably plowed under so near to the time for wheat seeding that it had not sufficiently decayed to be of use to wheat.

President Briggs: About Grand Rapids we had some experience with clover sickness. Some assign this to excessive use of plaster. Rest from clover cures the trouble. We like mammoth clover even for hay and much better for pasturage, chiefly because it holds on longer in the season than the smaller variety and is good through July and sometimes into August, depending on seasons. Our soil is neither particularly light nor heavy. The clover sickness was on light soil.

Prof. Beal: I think mammoth clover the best kind for planting with timothy if timothy is to be used at all. I am surprised to hear of this clover sickness. I have seen some of it. May this difficulty not be due to insects or fungi?

Mr. Hamilton: My early experience was on clay land, and there plowing under clover produced much better results than pasturing. Here on gravel soil I have not found plowing under so good. I cannot get a wheat bed sufficiently compacted below after plowing under clover. On heavy clays this point is rather an advantage.

Mr. Briggs: The proper time and manner of seeding depends on the seasons and is uncertain. If you sow in the fall you run the risks of the winter. I prefer to plant when the land is settled in the spring and then harrow *well* with a light, fine-toothed harrow. Don't be afraid! You will benefit the wheat instead of hurting it. I use the shoe drill to sow clover and thus get it ¼ to ½ inch deep. Think it will not germinate if much deeper.

Dr. Godfrey: I have practiced the method of curing clover mentioned by Prof. Beal, viz: putting it in the day it is cut and it is thus green, loses very little by scattering, and I can often get the price of timothy for it.

Mr. Morton: Twenty years' experience on soil near Grand Rapids leads me to expect the best results from sowing clover in the fall and timothy late in the spring. Putting clover into the barn the same day that it is cut can only be done if it grows very thin on the ground and wilts very quickly. I cut in the morning when the dew is on. As soon as the dew is off I cock up and let it sweat (if the weather permits) and put it in the barn damp and green and have no dust.

Dr. Godfrey: Jamestown has no such soil as Mr. Morton mentions. My clover crop is so heavy that the track clearer cannot make a way for a team the next time around.

Mr. Beaumont: At what stage do you cut?

Dr. Godfrey: The earlier the better, as soon as the heads are beginning to turn.

Secretary Clark: I see no difficulty in this question in view of the facts regarding ensilage, which is simply fodder stored when wholly green. I use a tedder and put clover in the same day it is cut when I can get around to it. Of course it will not do to put it in with dew on or outside dampness.

Dr. Godfrey: I dump my clover at the bottom of a tight barn and pitch my wheat on top of that.

Mr. Beaumont: Does your mow sweat?

Dr. Godfrey: I don't know.

Secretary Clark: Does the steam never hurt the wheat?

Dr. Godfrey: Never.

Mr. Moody: Can we get more benefit from permanent pasture than from plowing and re-seeding? Mr. Moody asked to see the hands of those who preferred permanent pasture, and three hands were raised. Those who preferred reseeding showed 100 hands.

Mr. Moody: My permanent pastures stood long drouths and I think we ought to keep some fields in this shape, particularly new fields while the stumps are rotting.

Mr. Hicks: I think we will come to a time when the soiling system will supersede pasturing.

Mr. Fritz: Does Mr. Moody think a permanent pasture better than one re-seeded?

Mr. Moody: I do.

Mr. Shaw: I voted in favor of permanent pasture. My father lived in a great dairy country in Ohio and there they pursued that policy. In Lenawee County they do the same and my own experience is in favor of permanent pastures.

Mr. Hoffman: The Ohio practice is, to frequently change pastures, not to let cattle run too long on one piece. In this way permanent pasture is best. I know of fields that have stood forty years in pasture, but the cattle are only allowed to run a short time on each field.

Mr. Reid: I would like to ask those from Ohio if they think Michigan soils as well adapted to permanent pasture as Ohio soils. I question it. I am not familiar with Ohio soils, but think in general that permanent pasture is not a good policy on Michigan soils.

Mr. Moody: Most of us have certain fields which are well adapted to permanent pasture, even though some of our fields may not be so. High and sandy soils need clovering and re-seeding to keep them in condition.

Prof. Beal: Many of us have ancestors from Great Britain, where permanent pasture is common. It is true that damp soils will often do better as permanent pasture, but uplands and lighter or dryer soils should be re-seeded.

Secretary Chamberlain says that a field plowed once in three years will produce three times as much hay as the same land unplowed.

Clover and timothy, our principal hay crops, are not suited to permanent pastures, whereas meadow fescue and some others of the more common English grasses will do better for such purposes.

Mr. Fritz: The chief trouble of our permanent pasture is, as stated, the kind of grass used. Permanent pastures are best with a great variety of grasses, often as many as twenty-five or thirty, and this gives flavor and quality to the butter. So in our meadows, by sowing a greater variety of grasses we would get better results.

Mr. Shaw: As to permanent meadow the trouble is in pasturing as soon as mown. You can't mow and pasture too. Keep your cattle off and you'll get one-third more hay. Farmers complain of grasses running out. The trouble is they are killed out by pasturing after mowing. Clover will last ten years if not pastured.

Mr. Fritz: Does any one know of a good grass for sandy land?
Prof. Beal: Red clover.

SOURCES OF NITROGEN OF PLANTS.

BY PROF. R. C. KEDZIE.

[Read at Rochester and East Saginaw Farmers' Institutes.]

Out of the sixty-five or more simple or elementary substances known to the chemist only thirteen are found in the crops grown on the farm. They have been called the chemicals of agriculture. Out of this bakers' dozen of elementary bodies, all the plants grown on the farm are formed. They do not all appear to be of equal importance in plant life; some appear to confer a high quality and great nutritive value to the plant, while others appear to possess little distinctive character. Some seem to be present in so large quantity in all ordinary soils that every plant finds enough for its wants. On the other hand a few are in such moderate amount in many soils and the available stock is so soon diminished that plants find difficulty in obtaining the supply required for producing large crops

Three substances in these chemicals of agriculture stand out in bold relief, imparting high quality to crops, augmenting their product, yet soonest exhausted in the process of cropping. These are potassium, phosphorus, and nitrogen. Wherever a field has been exhausted by cropping, the exhaustion consists in the absence in available form of one or more of these three substances. The dead cotton fields of the South and the tobacco lands of Virginia have been killed by the continuous removal of these three chemicals by changeless cropping. These dead fields shall find a resurrection when these elements are again restored, or when the slow but healing hand of nature shall bring into active form these elements of fertility now locked in insoluble combinations.

But we need not go South to find sick and dying fields. Wherever you find a farm that is run down and out of condition by continuous cropping, always taking off and never restoring the materials for plant growth, you may safely say that the farm is deficient in available supply of these three substances. These three are preëminently the chemicals of agriculture, and in determining the value of commercial manures these are the only substances taken into account. The last legislature passed a law regulating the sale of commercial fertilizers, and this law requires an exact statement of the quality of each of these three substances in fertilizers offered for sale in this State. These three substances have a commercial value as fertilizers as well recognized in the market as the price of wheat and pork. When it is said that nitrogen in the form of ammonia and nitrates is worth eighteen cents, phosphorus in form of soluble phosphates is worth twelve cents, and soluble potash is worth five cents a pound, it is affirmed that under suitable conditions the farmer can afford to pay such prices for these articles to use as fertilizers on his farm, because the increase of the crop will pay for the outlay and still afford a net profit to the farmer.

In this passing allusion to commercial fertilizers it is not my design to start a boom for guanos and super-phosphates, but rather to show the subordinate position they now hold in Michigan farming. When to buy and when to abstain is a question of highest importance to the farmer, and requires careful consideration and mature judgment. A kind-hearted duchess was shocked to hear that some of her poor neighbors had died for want of bread. "How dreadful! If these poor people could not get bread, *why did they not buy cakes* and not starve in this absurd way!" The farmer who neglects to make available the natural supplies of these prime factors of fertility lying dormant in his soil, but rushes off to get commercial fertilizers to take their place, is buying cakes of the duchess. The farming that pays (the only farming worth consideration) derives the bulk of these three materials from the soil; and commercial fertilizers, if used at all, come in to supplement the soil supply, not to take it place.

But the theme for discussion this evening is not manures in general or commercial fertilizers in particular, but the sources from which plants derive their supply of nitrogen. No subject has awakened keener controversy than the sources of nitrogen for plants. For more than a hundred years this matter has been before the supreme court of science for adjudication, and chemists of highest rank have appeared on the witness stand to give the results of years of laborious investigation and experiment on this subject. It was easy enough to show that nitrogen "in the active form," in the condition of ammonia or nitric acid, or in combinations capable of ready conversion into ammonia or nitrates, would readily contribute to plant growth. Yet the question continually came up, "Are these the only sources of nitrogen for plants? Can nitrogen in the so called inert form—as humose nitrogen of the soil, or free nitrogen of the air—contribute to plant nutrition?"

To one unacquainted with the peculiarities of this most peculiar substance, these questions would seem frivolous. The great reservoir of nitrogen is the atmosphere. The leaves of agricultural plants, representing in many respects both the mouth and stomach of the living organism, are surrounded and flooded with nitrogen every moment of their life. Why, then, cannot the plant drink from the cup thus constantly pressed to its lips the needed element for which it languishes? Yet the almost unanimous verdict of chemists is that atmospheric nitrogen is not the source of nitrogen for plants. A few chemists, such as Vielle of France, and lately Atwater of this country, teach that the free nitrogen of the air is one source of supply for growing plants. Yet the great body of chemists consider atmospheric nitrogen incapable of contributing directly to plant nutrition. Though dying for the nitrogen that penetrates it at every pore, the plant must yet take up the poet's wail, "Thou art so near, and yet so far."

While thus summarily dismissing the plant supply of atmospheric or free nitrogen, the question comes up about the humose nitrogen of the soil, or "the inert nitrogen of the vegetable matter of the soil." It seems to have been taken for granted that this combined nitrogen belongs to the same class of inactive materials as the free nitrogen of air. The question for our consideration this evening is whether this classification of the nitrogen of the soil with free nitrogen of the air as alike and equally incapable of contributing to plant life, holds true of every kind of plants grown on the farm?

It is a significant fact that the organic matter of the soil contains an average of 2 per cent of combinations of nitrogen, about the same amount that is found in well fermented barnyard manure. The humus of the soil thus contains from 2,500 to 6,000 pounds of nitrogen to each acre of arable soil taken to a depth of 12 inches, more than enough to supply the nitrogen for a score of the heaviest crops ever raised. What is the office of this combined nitrogen, what relation does it bear to plant nutrition? To summarily dismiss this large amount of combined material by calling it inert "of no more use than the free nitrogen of air" is to make a hasty generalization. Is it incapable of assimilation by all kinds of plants and agriculturally to be considered "light as a puff of empty air?"

Has not the epithet "inert" been applied without due consideration?

Four years ago I began a series of experiments on the relations of this organic nitrogen of the soil to plant growth, and three years ago I read an article on this subject at the Farmers' Institute, at Armada. The quantitative estimation of the nitrogen in these experiments had not then been made. The experiments have been continued year by year, and the results of these trials and the estimation of the nitrogen are now given.

CONDITIONS OF THE EXPERIMENT.

In order to determine whether any material is essential to the growth of a plant we endeavor to raise a plant in the entire exclusion of this one material, every other substance found in plants being furnished in sufficient amount. If the plant makes complete growth, growing "from seed to ripen perfect seed," and makes a healthy growth in complete absence of any given substance, then we say that substance is not necessary to the growth of that plant. But if the want of any given element is uniformly attended by unhealthy growth and incomplete development, then such substance is said to be essential to plant growth. Nitrogen is one of these essential elements, and no plant can make perfect growth without it.

If now a plant is supplied with every chemical element of growth in available form except nitrogen, and this only in some particular form of combination, the question is settled that the plant can obtain its supply of nitrogen from this particular combination if it makes perfect growth under these conditions. So also if one class of plants will make complete growth under these conditions, while other classes fail to make such perfect growth, the question is settled about the relative power of these two classes of plants to supply themselves from this source of nitrogen.

For this purpose an artificial soil must be used from which all other forms of combined nitrogen are excluded, and no form of combined nitrogen obtain access to it in the form of rain or dew, which usually contain ammonia and nitrates in small amount.

The body of such artificial soil was made of silicious sand which had been heated red hot to expel any ammonia and nitrates; the vessels used to hold the soil were new flower pots which had been heated red-hot for some time; the mineral matter was supplied by wood ashes, and a little pure soluble phosphate of lime; the water was distilled and made as free as possible from ammonia; the plants grown in a glazed room, freely exposed to light, but shut off from rain and dew, and finally 12 per cent of swamp muck was added to the soil as the source of combined nitrogen, this muck being a fair representative of the average humus of the soil.

A part of the nitrogen of humus is called active because it is readily converted into ammonia by boiling with caustic lime, but a part is incapable of readily forming ammonia, and hence is called inert. In order to discriminate between the active and inert forms of the nitrogen of humus, two parallel series of experiments were carried on, one with humus in the natural state, and one with humus that had been boiled for three hours with water containing lime in the caustic state, this series being labelled "humus without ammonia." A number of kinds of plants were used in these investigations, but the discussion of results is confined to two plants—red clover representing our great manural crop, "the nitrogen producer" of Vielle; and wheat, our great cash crop, representing "the nitrogen consumers."

NITRIFICATION.

During the season of growth a part of the inert nitrogen of humus may be changed into active form by nitrification. This process may be modified by the action of the growing plant, but would in other respects be the same in all of the series. It could not be estimated in the soils in which the plants were growing without changing the conditions of the experiments and deranging the conditions of growth. As its benefits would be given to all the plants of a given series, no effort at a separate estimation was attempted, the object being rather to determine the difference in capacity of these two classes of plants to secure nitrogen from a common source.

PLANTING AND HARVESTING.

The seeds for these experimental plants were planted the latter part of February and the plants gathered the fore part of August. The time of planting was selected because the chemical laboratory was heated by steam from latter part of February for balance of the college year and danger of freezing obviated.

The first year Clawson wheat was used as one of the experimental plants. This is a winter wheat, and, being grown under the conditions of spring wheat, it did not head out or attempt the formation of seed. The next year fall planting of all the experimental plants was employed and the plants carried through the winter by stove heat, and in summer the plants were carried to the greenhouses; but a few days of intensely hot weather and neglect of ventilation burned up the plants and the year's toil in experiment ended in disastrous failure, though the plants at one time gave good promise.

The next year a spring wheat was used which headed out and gave promise of results of value, but just before the plant was harvested a mouse went through ten heads. What he gathered I don't know and he never told, but the experiment was a failure. I mention these things as illustrating some of the difficulties and accidents of experimenting.

In 1885 the Minnesota Amber was used in the experiment, and the results were satisfactory both in wheat and clover. All of these crops, when their scientific value had not manifestly been destroyed by accident, were gathered, dried, weighed and finally their contents of nitrogen determined by analyses, involving an amount of work not recognized by persons who have never attempted similar investigations.

RESULTS.

To get a clear idea of the results of these experiments I present them to you under two forms: I. The relative increase of the total crop as compared with the seed from which it grew. II. The relative increase of nitrogen in the crop compared with that contained in the original seed. The seed is taken as the unit of comparison both for the total crop and the content of nitrogen.

HUMUS IN THE NATURAL CONDITION.

The Clawson wheat (1882) gave an increase of crop 60 times that of the seed, and the nitrogen increased 25 fold; while the clover for 1882 gave an increase 3,188 times that of the seed, and the nitrogen was increased 1068 fold.

In 1885 the Minnesota spring wheat gave an increase of crop 200 times that of the seed, and 116 times the quantity of nitrogen, while clover the same year gave an increase in crop of 11,405 times the weight of the seed, and the nitrogen was increased 3,892 times.

HUMUS DEPRIVED OF NITROGEN.

The wheat (1882) grown in a soil where the humus had been deprived of its nitrogen gave an increase of entire crop 8 times that of the seed, and the nitrogen just doubled, while clover the same year and in same conditions gave an increase of 1,597 times the weight of seed in the total crop, and 566 fold increase of nitrogen.

It is thus seen that the clover has a wonderful power of taking up nitrogen from the humus of the soil in circumstances where wheat has a far inferior power. This is shown alike in humus in the natural condition as found in arable soils, and the "inert and inactive" nitrogen that has been supposed to be of no worth to growing plants.

Why this difference between wheat and clover? Some will say that nitrification took place during the season of growth; that the distilled water with which they were watered during the season of growth may have contained a little ammonia, or the plants may have absorbed ammonia from the air, and thus in one or all of these ways the plants may have obtained their supply of nitrogen.

Grant all these possibilities the question still comes back, Why did not the wheat take advantage of these sources of active nitrogen as well as the clover? The soil was the same for both plants, they shared the same distilled water and grew side by side. These plants, so to speak, sat at the same table and had the same bill of fare. Why was one lean and hungry, while the other waxed fat, unless the one had the power to eat and digest some article on the table for which the other plant had no stomach? Can we explain these results except upon the assumption that clover has a power of taking from the combined nitrogen of the vegetable matter of the soil a supply of nitrogen under circumstances where wheat fails to obtain a sufficient supply? Is the great value of clover as a manural crop to be explained by its power to accumulate from this source a supply of nitrogen which may supply a cereal crop following where the cereal would fail but for the intervention of the clover?

When the clover has taken up this soil nitrogen and made it a part of its own structure; the nitrogen is no longer inert and useless; it has become active and available: it has "enlisted for three years or during the war." When the clover is returned to the soil either as a whole crop, or as clover sod, or as manure of stock fed on the clover, this accumulated nitrogen is available for any subsequent crop. This is a fact which demands your thoughtful consideration. If clover has the power of appropriating and assimilating this most costly and precious element of plant growth from sources most abundant, but practically unavailable for plants of highest agricultural value, this becomes a question of high import to the practical farmer. "The power of one plant to accumulate and store up in the soil the materials for the sustenance and development of subsequent crops lies at the foundation of scientific agriculture."

But some one may object that these laboratory experiments differ widely from the conditions of plant growth in the field. "What matters it to us that your laboratory plants gain one or one thousand times the nitrogen in the seed? That is not the way we raise crops on the farm."

There is force and apparent justice in this criticism. The conditions of growth in the two cases are dissimilar and they must be in order to make the experiment decisive. If you are testing some article of food for stock to determine whether cattle will live and thrive on that single food, you do not allow your steer to browse around and feed on everything in his way in addition to this fodder, but you shut him up to that article alone to see whether he will thrive on this alone, and thus only you come to *know* what its food value is for a given kind of stock. The same in wheat life. If we would know whether a plant can derive its supply of nitrogen from a given source we must grow that plant in such way as to shut it up to that single source of supply, and not leave it free to obtain a supply from other quarters. Experimenters in Agricultural Chemistry have hit upon no better way for settling these questions than such artificial mode of growth by exclusion of intercurrent means of supply.

A word about the value and meaning of these results. The first and most important feature of soil exhaustion in ordinary farming is the want of an adequate supply of active nitrogen. A full supply of this material means not only an increase of vegetable growth, but crops of superior value, bushel for bushel, and ton for ton. It means more hay, more wheat, more corn, and all of these of better quality. It means more stock and in better condition. In a word, it means *prosperity on the farm*. Prosperity on the farm is quickly followed by increased activity in mine and shop, the calling of hungry hordes of unemployed workmen from the streets and alleys to farm and shop. It means the revival of trade and the unloosening of the white wings of commerce. These are some of the possible benefits to spring from a satisfactory solution of this question of increased supply of available nitrogen.

THE AGRICULTURAL BAROMETER.

Thirty years ago the average crop of wheat in this State was about thirteen bushels to the acre ; it is now twenty-two bushels. Michigan thus stands at the head of the class in the acreage product of wheat. I know of no single test of the agricultural standing of a State better than the average yield of wheat to the acre where this crop is extensively sown. I call this average acreage product of wheat the *agricultural barometer* to measure the level of farming in the United States. Measured by this standard Michigan has the highest standing both by the United States census of 1880 and by the results reached by our Secretary of State. What has brought Michigan agriculture to this high level? Many causes combined: brains in farming, a good soil, improved machinery, new varieties of wheat; and in addition to all these the general cultivation of clover, thereby securing increasing fertility instead of exhaustion of the soil by cropping. Our farmers in general have recognized the value of clover preceding wheat We see some explanation of this value in the power of clover to accumulate nitrogen from a source where wheat relatively fails, the clover accumulation making good the deficiency of wheat in this regard. We also find a reason why a supply of humus in the soil is beneficial to the clover. By long cultivation, especially of light soils, the vegetable matter rapidly disappears, the land seems to bleach out and clover is not a success. May not this be caused by a deficiency of the very material upon which clover exerts such a wonderful power? The need of keeping up the supply of humus in the soil and thus securing one condition for the best development of clover appears evident. In this battle of life, if the charge of the clover brigade ends in defeat, the rest of the campaign becomes a desultory skirmish with hard times.

THE PROCESS OF RIPENING.

In the clover and wheat plants of 1882 no ripe seeds were formed, and the wheat did not head out. In 1883 the plants grew all winter, the wheat formed heads, but the blighting of the crop by excessive heat prevented seed formation. In 1884 the spring wheat headed out, and I suspect seed formation took place, from the way the mouse overhauled the heads of wheat. In 1885 the four wheat plants with thin branches formed a number of shrunken grains weighing 5.29 grains (air dry). The grains had about the appearance of some wheat I cut just as the milk began to appear in the kernel, in some experimental researches in 1879. The shrunken and immature grain in the experiments of 1879 was found to be richer in albuminoids than the plump and fully ripened grain. The same result comes out in the imperfect grain of this experiment, the amount of albuminoids being 15.37 per cent. It is the common impression that the shrunken wheat has but little value for food as compared with plump grain, whereas it is of greater value pound for pound, because richer in the most highly developed constituents of animal food.

VALUE OF THE STRAW.

The straw of this imperfectly ripened grain was much richer in nitrogen than ordinary wheat straw. Wheat straw from the straw stack was analyzed during this investigation and found to contain .28 of one per cent of nitrogen, whereas this straw with partially ripened grain contained 1.2 per cent of nitrogen, or more than four times as much as ordinary wheat straw. It is nearly as rich in albuminoids as timothy hay.

This suggests an inquiry into the fodder-value of wheat straw at different periods of ripening. In the investigation into the value of wheat at different periods of cutting, no attention was paid to the straw. I propose this year to extend the investigation into the value of the straw of wheat and other grains at various periods of ripening, to see whether it is worth while for the farmer to cut his grain at a certain stage of ripening with a view to the value of the straw as food for stock. If early harvesting will give greater profit in the value of the straw, as it certainly does in the grain of wheat, then it is a fact which the farmer should know and use.

Mr. Ball: What are the practical deductions from these experiments regarding nitrogen?

Dr. Kedzie: Grow clover or other legumes and see that they are provided with plenty of humus from which to draw their nitrogen.

Whether plants can use the free nitrogen of the air has been decided in negative by numberless experiments.

Mr. Ball: I understand that clover can utilize inert nitrogen which wheat cannot, and convert it into a form in which wheat can use it.

Dr. Kedzie: Exactly. In cultivation, a certain amount of nitrogen is available in any soil, but the larger part is not available for cereals.

Liebig says whatever a crop takes from a soil is the measure of its exhaustion of the soil. If so, why does clover, which takes more nitrogen than any other crop, yet enrich our soil?

Mr. Ball: It takes it from the air.

Dr. Kedzie: No, sir. It cannot get it from the air. Mr Gilbert says we are consuming our capital of nitrogen in the soil and will soon exhaust the supply. Why, then, do we now raise 22 bu. per acre, when a few years since we raised 13?

Mr. Ball: We are simply exhausting more rapidly our soil by better culture.

Dr. Kedzie: Vegetable matter in changing into humus absorbs nitrogen from the air and fixes it in inert form and then the clover can use it.

Mr. Ball: Can not plants absorb through their leaves the ammonia in the rain?

Dr. Kedzie: That is possible, but the source is too small to be of moment. Ammonia is so minute a constituent of the air that only about six pounds per acre is brought down yearly by rains, or 8¾ pounds in both nitrates and ammonia—not the one-fifth part of what is required for any crop.

Mr. Peabody: I have sown much plaster and know nothing as to its value; have tried it everywhere, but cannot be sure of its value, particularly in such doses as 50 pounds per acre. I have noticed that burdocks grow in black soil and that poor soil where they grow becomes good. Are they restorers to the soil? Is not a clover seed crop a robbery of the soil? How are we to find the value of commercial fertilizers? I have seen the effects from plaster half a mile away and yet know no means of estimating its cash value.

Dr. Kedzie: How much plaster did you use to the acre?

Mr. Peabody: Fifty to 200 pounds.

Dr. Kedzie: Fifty pounds is enough, because it is *very* sparingly soluble. Our rainfall averages 32 inches per year and that amount cannot dissolve more than 50 pounds to the acre. Any more is inert. The College experiments showed that plaster on corn increased the stalks but did *not* increase the *grain at all* and this is the general conclusion. All leguminous crops under proper conditions are benefited by plaster. Clover seed is rich in nitrogen and its removal takes a good deal of nitrogen from the soil, but not as much as the crop makes up for.

Mr. Peabody: Is salt a poison to plants?

Dr. Kedzie: A small amount of salt is good, but a large amount is fatal to inland plants, though good for cabbage, kale, and other sea-growing plants. I would advise the extermination of burdocks. On light, porous soils having a good proportion of vegetable matter, three to five bushels of salt per acre in the spring, about the time of the last snow in April, is beneficial, but on clay and other damp soils or those deficient in vegetable matter, salt is of no value.

Mr. Fischer: A year or two ago a writer said that he improved the quality and quantity of his wheat, increasing his yield in five years from 25 bushels to 40 bushels per acre, by sowing clover in the spring with his wheat and then after the wheat had been harvested, plowing the clover under.

Dr. Kedzie: A field in clover two years and wheat every third year for 40 years improved right along.

Mr. Fischer: My authority was Mr. George Geddes, and he said he sowed clover among the wheat in the spring and after harvest plowed the clover and wheat stubble in and re-sowed wheat.

Dr. Kedzie: No one disputes the value of clover. The valuable elements in the plant are hardly touched by the animal in digesting them. The excrements contain all except so much as goes to form flesh. If you will feed clover to stock the manure is as valuable for the land as was the clover.

Mr. Bow: Which has the most nitrogen, the root of clover or the part which we take from the land in making hay?

Dr. Kedzie: It is about equal.

President Willits: So after removing the crop you have only taken one-half of the product?

Dr. Kedzie: Yes.

President Willits: And that half the clover has developed from material that was inert and unavailable beforehand for the wheat?

Dr. Kedzie: Just so.

WHEAT CULTURE IN SAGINAW COUNTY.

BY DENNIS BOW, OF BRIDGEPORT.

[Not having been able to obtain the manuscript of this article, I clip the following resume of it from the Saginaw News.—SECRETARY.]

The gentleman stated that he was better at raising wheat than writing about it, and considered it a subject of great interest to every farmer. Whether it will pay to raise wheat at 85 cents per bushel is a question very often asked. From a tabulated statement made up from reports from 650 townships an itemized account gives the cost of raising and marketing one acre of wheat at $12.99. This includes interest, taxes, wages and repairs. Taking this as a basis it would be necessary to raise 15¼ bushels to pay expenses, leaving a pretty wide margin for profit. The same report gives the cost of raising a bushel of oats at 29 cents and corn at 21 cents per bushel of ears, leaving little or no profit. Mr. Bow's observation has been that the purchasing power of wheat is about the same whether it is 85 cents or $1.00. If wheat is low everything else is down; if high, everything is up; wheat, as it were, holding the balance of power. Among the few necessary things to be observed are thorough drainage, thorough cultivation and the using of a heavy roller before sowing, not often. By sowing clean, from the 1st to the 10th of September and observing these conditions we may reasonably expect to harvest a good crop of clean wheat and no chess. Has never known wheat turn to chess when the above conditions have been complied with. Specific rules can not be given to fit all sorts and conditions. Each one must study his own condition and shape his practice to them. The Clawson variety is best for this section. Side by side it has fought its way with other varieties, and has always given the most satisfactory results, and although condemned by the millers it has fought its way to the front, where it stills holds the fort. Whether the wheat has changed or improved processes of manufacturing have produced these results the gentleman was not prepared to say. In order to obtain good crops the fertility of the soil must be kept up, and this can be done with clover, plaster and sheep. Mr. Bow has always obtained the best results on corn stubble. Turn under a clover sod, cultivate the corn thoroughly, always bearing in mind the better you work the ground the better the corn, and at the same time you are keeping the soil in good condition for the wheat, thus killing two birds with one stone.

At the conclusion of the reading of the above able paper the following discussion ensued:

Mr. Jno. Fischer: I would like to ask if it would not be more profitable to raise one half the number of acres of wheat that we now do and plant it in drills one foot or more apart far enough to admit of horse cultivation. I think five acres would give as great a yield as ten by the old method. All other crops except cereals we expect to cultivate, and reap correspondingly better results by so doing.

Dr. Kedzie: Has Mr. Fischer tried this?

Mr. Fischer: No, I shall try it this fall.

Mr. ———: I think Mr. Fischer's suggestion, while good, is not entirely new, but has been long practised in the Netherlands, where they get such enormous crops.

President Willits: In England they not only cultivate wheat but they hoe it and manure very heavily. The question is whether such culture would pay here with our cheaper soils and cheaper wheat. I think it has been tried at the Agricultural College, but cannot report definitely. At St. Louis some one stated that one experiment at the Agricultural College had been of more benefit to the State than the entire cost of the institution, viz., Dr. Kedzie's experiments relative to Clawson wheat, whereby the adverse reports of the millers were controverted, and the value of the wheat established.

Dr. Kedzie: When the discussion about Clawson wheat came up it was analyzed at the University, and on the strength of that analysis graded by the millers as No. 3 red—a mere point better than chess. I was called upon, and secured two bushels of each of the leading varieties, had them ground myself and baked by bakers who were ignorant of the varieties, and had the bread tested by leading citizens of Lansing, with results all in favor of the Clawson. I also tested content and character of gluten in Clawson and other wheats, and then presented the results at the Tecumseh Institute, where the secretary of the Millers' Association was present, prepared to haul me over the coals, but after hearing me he had nothing to say. As to hand culture of wheat, this is the universal practice in the old world, and not only that but they dibble in the seed and care for the crop as for an onion bed, because labor is cheap and land is high. But though they thus get 40 bushels per acre when we get 20, yet our cheaper lands and cheaper transportation enables us even with our costly labor to whip them out.

Mr. Fischer: As to cost, we can plant with drill by removing every alternate spout and cultivate by cheap horse labor.

Mr. Geddes: Mr. Travis of Oakland county has grown wheat in this way, in drills 14 inches apart, for the last 7 years.

Mr. Robt. Ure: In England they get the poor-house occupants to hoe their wheat, but all labor is getting so high that even their big crops hardly pay.

Mr. Dennis Bow: I have raised 40 bushels per acre (last year 42½), and when we have such crops it is often not able to hold itself up. In order to pay the extra cost of the method suggested by Mr. Fischer, we should get 60 bushel per acre, and I don't see how the straw could hold up any such crop. I have tried salt on a light soil and could see no result.

Mr. Geddes: I have found harrowing in spring and subsequent rolling very useful. As to salt, I had a piece of barley, part of which was turning yellow (sandy loam soil, clay subsoil, with plenty of manure and well cultivated) from insects or something of that kind, and I sowed 3½ bushels of salt per acre and it remedied the trouble at once, and in harvest the yellow part of the field was as good as the rest.

Mr. Webber: I had in my vegetable garden, on a heavy clay sub-soil, under a foot of dark mould, great trouble with cut-worms. I sowed five bushels of salt per acre and was troubled no more by cut-worms. As to wheat, I think our worst troubles are the want of drainage and the March freezings. I have often had wheat fields in early March that promised forty bushels per acre. The warm sun melts the top inch of the soil and at night the thermometer drops to 16° F. and freezing the top lifts the wheat from its lower roots that have never been thawed out and kills it. This is on undrained soil.

Mr. Norris: Mr. Geddes speaks of the land roller. I think it one of our most useful tools and use it before and after sowing wheat.

Mr. Bow: Some years ago I rolled wheat on sand after sowing and as a result the wind blew the sand from the roots. On clay, if rolled when damp, after sowing, a hard surface will be formed that much of the seed will never break through. I pack the ground as well as I can before sowing and so get the best results, finding that the headlands where the horses turn and pack the soil very solid, are the best parts of the field.

Mr. Fischer: If we want our soil so compact, why plow? why not simply harrow a seed bed?

Mr. Geddes: As to wheat heaving, I would ask Mr. Webber if he ever tried rolling in the spring?

Mr. Webber: No, because the soil was too damp. It would only make mud.

Mr. Geddes: Is not Mr. Bow's experience about the compacted ground where his horses turn giving the largest crop due to completer cultivation there?

Mr. Graham: I rolled thoroughly and then pulverized and put a ton of salt on four acres, then sowed wheat and rolled again, (4 times in all) and got 35 bushels per acre.

Mr. Robert Ure: Light sands should be rolled; not heavy.

THE POTATO ROT.

BY A. A. CROZIER OF GRAND RAPIDS.

[Read before the Farmers' Institute at Hudsonville, February 2, 1886.]

The potato rot has been more than usually destructive the past season. The estimated loss from this cause is nearly a third of the crop in Michigan, and greater in New York and other neighboring States. Whether these estimates are correct or not, there are many localities where the crop of late potatoes has been almost destroyed by rot, and the fear of loss in other cases has often prevented dealers handling the crop except at extremely low prices; so that though prices are now high in many sections of the country, growers have not obtained the usual benefit.

The appearance of the rot the past season followed the unusally wet weather of the latter part of summer, and potatoes which ripened early were generally sound. The rot has also been most severe on clay soils. Reports from a number of potato growing districts in the northern part of the State, where the soil is generally light, show that the rot there is nearly or quite unknown.

BRIEF HISTORY.

The potato rot is not new. Nearly every year the crop rots to come extent in one locality or another. Little notice was taken of it, however, until 1845, when the first serious failure of the crop from this cause in that and the year immediately following, caused extensive famines in Ireland, England and Germany. Previous to that time considerable injury had been caused in some years by "dry rot," "wet rot" and "curl," which are now attributed to the same disease. Rot, apparently the same as our potato disease, appeared in Canada in 1844, in Germany in 1842, in Scotland in 1832, in parts of France in 1816, and at various other times and places, and has apparently existed to some extent ever since the potato was brought into cultivation. It may have originated in the home of the potato in the warmer parts of America. Joseph Acosta, a Jesuit, observed in Peru as early as 1571 that the tubers often spoiled in the earth from "blight or mildew" during or after cold, bad weather. On the table lands around Bogota, according to Boussingault, the potato spoiled in moist situations every year, and in wet seasons spoiled everywhere.

APPEARANCE OF THE DISEASE.

The disease makes its appearance about the last of July or early part of August, usually after a period of damp, muggy weather. Its appearance in 1845 is thus described by the Commissioner of Agriculture of the province of Groningen, Holland: "The intense heat of the summer was succeeded by cold, rainy weather from the middle of July to the end of August. On July 21st and 22d there was an extensive fog, and on the 28th the first blight appeared." In England the season was also unusually moist. From the first to the tenth of August it was hot and humid, causing an unusually vigorous growth. This was followed by cold, and in some cases frost. Within ten days the potatoes were struck with blight all over England. Not long since I was talking with a farmer who came from Ireland in 1847, in which year the rot was also severe, and he described a similar condition of weather there at the time of attack. The season had been moist and the potato vines were exceedingly vigorous, of a brilliant green and covered the whole ground. There had been a dense fog which lasted two days, after which the sun came out hot, and the vines soon blackened and died as from a heavy frost. The tubers, at the time the tops died, were uninjured, but in a few days when they came to dig, two men in all day could not find enough sound potatoes for supper. The rot first appeared in the tubers just beneath the skin, but soon, as he described it, "melted right away to the center."

All agree that the disease first makes its appearance on the tops. It shows first as small frosty spots, usually on the under side of the leaf. As the spots enlarge the centre becomes brown and dies, and the leaf or a part of it withers. It is then that the disease is usually first noticed. Soon the stem is attacked, and usually, in a week or more, according to the weather, the tubers also. Occasionally, in case the weather turns cool and dry, the affected leaves and stems dry up, and the disease goes no farther, so that the tubers escape. When the tubers are attacked, the disease first shows as fine, brown specks and streaks just beneath the skin, and from the spot first attacked, it spreads over the potato, more rapidly near the surface than toward the centre, so that the whole outside to the thickness of an eighth of an inch may become diseased, while the interior remains for a time sound. The rot often appears first on the half ripe seed end, or knobby points. In moist situations the diseased portions are soft and watery, and the rot spreads quite rapidly, and in this condition is often called "wet rot." In a dry situation the affected parts dry and shrivel up and spread more slowly, or in cool weather apparently not at all. Thus dry rot and wet rot are not necessarily different diseases.

CAUSES ASSIGNED.

Material amounting to hundreds of volumes has been written on the cause and remedy of the potato rot. The most widely assigned cause is a loss of vigor, or debility of the potato, since its introduction into cultivation. Various causes are assigned for this: The use of tubers instead of seed for propagation, the use of small or unripe tubers, the cutting of tubers for seed, excessive manuring and high cultivation, deficiency in the soil, our changeable climate, the excessive production of tubers, and the slight tendency to produce blossoms and seed, in our cultivated varieties. Notwithstanding all this it is not very clearly proved that the potato has degenerated. Wild sorts brought from their native mountains in Central and South America, and grown by the side of our cultivated varieties fail to show any remarkable difference in vigor, and they are certainly not exempt from rot, either here or in their native countries.

Some attribute the rot to atmospheric influences, since it has been noticed to follow certain kinds of weather. A man in Washtenaw county announces the cause as nitric acid deposited from the atmosphere on the plant in rain or dew, and his neighbors testify to the truth of his discovery. It is commonly believed in the State of New York that the rot this season was caused by the excessive lightning which occurred during the month of August.

Others attribute it to plant lice, or other insects, which poison the plant; to over-ripe, under-ripe, too large or too small seed; to the absence of salt or some other element in the soil; to want of ozone in the atmosphere; to a plethora or stagnation of its juices; to a Divine judgment, or the influence of comets.

THE TRUE CAUSE.

Notwithstanding all this difference of opinion all scientific writers who have examined the subject are now agreed as to the cause of the potato rot. From what has been said thus far it might be inferred that the rot is a single disease. But we must distinguish, as Dr. Farlow says, "between potatoes affected by the rot and rotten potatoes." Any potato left in a sufficiently wet place will become rotten, especially if injured by freezing or in any other manner. After the attack of the true potato disease, rot from other causes sometimes sets in and hastens decay. Several kinds of fungi attack and injure the tops. But, from what has been said, it will not be found difficult to distinguish the true potato rot from all other diseases of the potato, especially after one has once recognized it. Besides, the injury to the crop from all other diseases is usually much less than that caused by the true potato disease.

This disease is caused by a parasitic fungus, a minute, mildew-like plant which attacks the potato plant, both tops and tubers, while living, and feeds upon it, causing decay. This fungus is said to attack not only the potato, but also the smaller bittersweet (*Solanum Dulcamara*) tomato, petunia and other plants of the potato family. The fact that this fungus is the direct cause of the rot was established about 1860 by Dr. A. DeBarry, now Professor of Botany at Strassburg. Previous to that time this fungus was known and occasionally assigned as the cause of the rot, but the best authorities then believed that all fungi were a consequence, and never a cause, of disease; and even when it became demonstrated that certain fungi could attack living plants, it was long contended that they only attacked feeble plants, or those in a morbid condition.

This fungus was long known under the name of *Botrytis infestans*, but at the time when it was discovered to be the cause of the rot it was known as *Peronospora infestans*, and since that time the genus Peronospora has been divided and it is now classified as *Phytophthora infestans*. It was found on the blighted leaves of the potato, and was carefully studied by Dr. De Barry, who found its branching vegetable threads extending through the living tissue of the leaf surrounding the decayed spots. By numerous experiments he proved that it was the living and not the dead tissue which supported the fungus. Usually nearly all the cells of the potato are filled with starch grains, but where the fungus threads are present there are fewer, and where the tuber is completely blackened by the disease only the empty cells remain and the threads of the fungus, which are very soft and delicate, have nearly or quite dissolved. These thread-like branches of the fungus pass all through the tubers, stems, and leaves, extracting nourishment and causing decay. Before the potato plant dies, however, and consequently the fungus also, branches of the fungus may extend into the air and bear fruit. These fruiting branches are most abundant on the lower surface of the leaves, and form the white frosty patches already mentioned. The branches generally emerge from minute openings or breathing pores (stomata) which are abundant on the lower surface of most leaves. The seed-like bodies or spores which grow singly on the ends of the branched fruiting stems, and appear to the unaided eye like a fine white powder, are produced in large numbers, and as they fall succeeding crops are produced from the same branches. These spores germinate in three ways. When placed in water, as on the moist surface of a potato leaf or tuber, some of them will in a few days swell up and expel their contents in a mass which emits a germinating tube that penetrates the plant, either through one of the minute openings mentioned, or, more commonly, directly through the surface. Usually, however, preparatory to germination, and especially in darkness, the contents of a spore breaks up into from 6 to 16 bodies called zoospores, or living spores, which escape and move about for a time in the moisture, propelled by two whip-like cilia or tails attached to a joint on this lower surface. These lively bodies, appearing like little animals, finally settle down upon the plant, lose their cilia, take on a cell wall, and soon germinate and penetrate the plant as in the former case. Sometimes, instead of the contents of a spore dividing directly into zoospores, a short germinating tube is produced, at the end of which a single spore is formed, the contents of which divides into zoospores.

The spores of the fungus (conidia) in hot dry weather do not live more than a day or two, and never live over winter, but in suitable weather they may live for several weeks and be blown through the air to great distances, carrying the disease to other fields. When the spores fall upon the ground, if a rain occurs at the proper time, they may be washed into the soil and there germinate and penetrate the tubers, in which they develop and cause the rot. Probably the greatest damage to the tubers from this rot comes from spores which reach them in this way. Tubers placed in the ground have been induced to rot by placing tops, containing spores of the fungus, on the surface above, and applying water. Professor De Barry, who tried this experiment, has repeatedly found the germinating spores in the soil. It is also probable that the mycelium, or vegetative portion of the fungus, is able to reach the tubers from the diseased tops by passing downward in the stem, though it is not certainly known that potatoes become diseased in this way. Certain it is that the fungus threads which live over winter in partly diseased tubers pass upward in the germinating shoots in the spring, and cause disease in the tops.

So far as is known this is the whole history of the fungus which causes the potato rot. It is produced from spores which germinate on any part of the plant, apparently preferring the leaf; enter, and live mostly within. It passes the winter in partly diseased tubers, from which it reaches the growing tops the next season, where it produces the next crop of spores. No process of fertilization is known, and no true sexual fruit produced, as in most plants, though in certain closely related fungi, one of which lives on the grape, such fruits, called resting spores, are known, and are an important feature in enabling the fungus to pass the winter. Mr. W. G. Smith of England, thinks that he has discovered similar resting spores, and a process of fertilization, in the potato fungus, which he describes and figures in the last (ninth) edition of the Encyclopedia Britannica and elsewhere; but other botanists think that what he has seen belongs to another fungus.

REMEDIES.

A knowledge of the cause may not always enable us at once to provide a remedy, and most of the remedies we have for the potato rot were discovered before the true cause was known, and were based on entirely erroneous theories. Still, an earlier knowledge of the cause would have saved the waste of much valuable time and may now enable us to judge somewhat of proposed remedies before trying them.

1. It is evident from the manner of growth of the fungus, almost wholly within the potato plant, that we can expect little from remedies directly applied, and applications of sulphur, lime, etc., which are destructive to fungi growing mostly on the surface of plants seem to have little effect here. Still, we cannot say that it is impossible that there may be something applied to the leaf or roots which, absorbed into the tissues, will destroy the fungus without injuring the plant. Recent apparent success in France in checking the related grape peronospora, by applications to the leaves, gives ground for hope. So far as we now know there is more reason to expect success from the application of lime, ashes, sulphur and salt to the soil, which, while they assist the growth of the plant, may perhaps destroy the germinating spores of the fungus. There are cases in which the rot appears to have been prevented by such applications, but we need more experiments on remedies of this kind.

2. Another plan which will suggest itself, considering that the disease seldom appears before about the first of Augus , is to plant early and have the crop as far advanced as possible by that time. In this way early varieties can be made practically safe from the rot; for even if they are not entirely ripe and out of

the way by the time the rot appears, the vines and tubers are so mature that for some reason they seem almost exempt from attack, even when rapidly growing late sorts near are badly affected. The plan of avoiding the rot by having the crop early was long ago adopted by the farmers of England and Ireland, who in order to obtain an early start place their seed potatoes in a warm place in the house or barn for a few weeks before planting, to have them well sprouted. Every means possible should be used for this purpose,—a warm exposure, sandy soil, frequent cultivation, liberal fertilization (except with raw manures)—everything that will bring forward the crop as rapidly as possible. In some experiments on the Mercer potato, published in the report of the New York Agricultural Society for 1860, Geo. R. Underhill states that of three plantings at intervals of three weeks, and under otherwise similar conditions, the first planted about April 1, ripened without the appearance of the disease; the second planting rotted to a small extent, and the third rotted badly.

3. Another remedy largely used, is hilling up. Of late years this practice is being discontinued in this country, and except to a slight extent in some cases, to protect the tubers from becoming sunburnt, it doubtless is generally of more injury than benefit. But there is a large amount of evidence to show that potatoes hilled up, so that the hills will shed rain, are less liable to the rot. Mr. Erwin F. Smith, in an excellent article on the potato rot in the Michigan crop report for December last, states that hilling potatoes is not a remedy. The reason given is based largely on the experiment of DeBarry, already described, in which spores of the fungus placed on the surface of the ground and water applied caused rot in tubers buried beneath. The spores are so minute that they are easily carried into the soil with the water, where they germinate and attack the potatoes. It is obvious that hilling up, to be of use, must exclude the water at the time the spores are ripe. In addition to hilling up some growers in France and England have thought that they have lessened the liability to rot by pressing the top to one side over the furrows by means of a light roller, so that the spores which fall will be washed into the soil beyond the reach of the tubers. Great care is also taken in hilling up to press the earth close about the stems in the middle of the hill so that water will not enter at that point. So far as I can judge hilling up seems to be a partial remedy and deep planting to have somewhat the same effect.

4. Another remedy, in case the blight appears on the tops, and when from the state of the weather a severe attack may be expected, is to mow or pull the tops. If frost occurs this is not necessary. The tubers of course will not enlarge after the tops are removed.

5. As to whether it is best to dig at once on the attack of rot, or leave the crop in the ground as long as possible there is difference of opinion. The safest way is probably to dig at once, certainly if the ground is wet.

6. In storing it is important to have a cool, dry place and dark. The partly decayed tubers should be separated as much as possible from the others, for although it is not certain that the disease spreads from affected to sound potatoes, the presence of the moisture from those badly decayed seems to cause the rot to spread more rapidly in those less decayed. The presence of fermenting tubers probably raises the temperature somewhat, and so also aids the spread of the disease. Air-slaked lime is sometimes used to check the rot. So far as this tends to dry the tubers it is of use. It is also said that the fruiting branches of the fungus are sometimes found on the tubers. They certainly have on those which were cut. In such a case lime would doubtless destroy the spores and prevent them attacking sound tubers.

In some places it is the custom to put dry earth in the pit among the potatoes. As both light and air favor the production of the fruiting branches of the fungus this is probably a good thing. It is probably impossible for the vegetative branches to pass in the pit from one tuber to another. In one case, however, out of several where I fastened the cut surfaces of a sound and a diseased tuber together the threads of the fungus appeared, with all the marks of the disease, in the previously sound tuber in a few days.

7. Do varieties differ in their liability to this disease? They undoubtedly do. Early varieties are certainly most exempt. The Late Rose seems to be especially liable to attack, but with most varieties now in cultivation in this country little has been observed in this respect; though of older sorts quite a list might be given of varieties said to be especially liable to or especially free from rot. We need careful observations on this point. It has been thought that plants raised from seed would be less liable to attack than those from tubers, but it has been proved that seedlings are often attacked, even the first season, and nothing need be expected from the frequent introduction of seedlings, except that some new varieties will likely be more liable than others to the attack, from which the best can be selected. The mere fact of being a seedling apparently makes no difference.

8. The condition and location of the ground as to moisture is important, as moisture favors the germination of the fungus and perhaps, its further development in the plant. The soil should, therefore, be sandy or well drained. All low, damp, or foggy locations should be avoided if rot is feared. Exposed situations, where little dew is deposited, and that little soon dried by wind and sun, are to be preferred. It is also evidently desirable to keep the crop as free from weeds as possible, which shade the soil and retain surface moisture. For the same reason wide planting is beneficial, and the growth of varieties with upright and not too rank foliage.

9. As the fungus lives over winter in the diseased tubers it is especially important to plant none but what are sound. Seed potatoes should be obtained from fields or localities known to be free from rot. Merely choosing apparently sound ones from among others is not safe, as it is impossible to detect slightly diseased tubers without cutting them up too much. Other advantages from a change of seed may be obtained at the same time, and so make the change desirable in cases where, from but a slight danger from rot, it would not seem worth the trouble.

10. Avoid planting on land where the crop has rotted the preceding year, for though no part of the fungus is known to pass the winter except in living tubers, spores capable of passing the winter may exist and be present in such localities in old tops and decayed tubers. An undoubted danger on such land is from volunteer plants from potatoes left in the soil. These should be destroyed as soon as they appear, for if they are from diseased tubers they will almost certainly become diseased and infect others.

CONCLUSION.

These seem to be the most important remedies we now have. Others will suggest themselves to one who considers the cause of the rot. None of these can be depended on to completely eradicate the disease when once established, and it is doubtful if we shall ever be entirely rid of it. The fungus has already spread nearly everywhere that the potato is grown, though it is quite probable that the exemption of some localities from attack may be due to the absence of the fungus in that region at the time.

Seeing, then, that we cannot hope to be wholly free of the disease, the question arises whether the rot is likely ever again to become as destructive as in the past. The disease is not an insignificant affair to be ignored. This frail and almost invisible parasite has, it is estimated, caused in Ireland alone, a little island of rocks and bogs, no larger than the State of Michigan—to say nothing of its ravages in other countries—a greater loss of life than all that have been lost by the United States in war since the government has existed—more than in the long struggle of the revolution, in the war with Mexico, in all the massacres by Indians, and all that were killed on both sides in the great rebellion. And yet, about the only record this makes in history is a row of figures and a short paragraph in some encyclopædia. About all that has been done by the British government, which has suffered so much, toward preventing the disease, has been to appoint a commission which failed to discover anything, and to award a medal to a man whose discoveries are not believed. And as for our government, we never have had a potato famine; the subject has hardly been thought of. Whatever has been done toward discovering the cause of the disease has been done by scientific men in the pursuit of knowledge; and about all that has been discovered in the way of remedies has been by those who grow potatoes for a living.

Still, it is not probable that in this country we shall ever see as great destruction from the potato rot as has occurred in the past. Our climate, on the whole, is less favorable to the disease than that of the countries in which it has been most destructive. The variety of climate in this country renders it unlikely that the rot will ever prevail extensively in all portions of it at any one time. Modern methods of transportation enable a loss in any locality to be quickly supplied, and the days of the world's great famines are probably past. But let it not be forgotten that the great loss of life from the failure of the potato crop would not have occurred had not large bodies of people relied almost entirely on this one crop for support. Therefore, if we grow a suitable variety of other crops, and remember that the rot never causes extensive disaster suddenly, but shows its presence for a year or two in advance, when such remedies as we have may be applied, we may expect to continue to raise the potato without excessive risk.

Mr. Beaumont: Did Mr. Crozier say raw manure was injurious to the potato crop?

Mr. Crozier: Yes; in inducing scab, and also in retarding maturity.

Prof. Beal: I have tried potato seed from South America and from Montana and found both subject to rot.

Mr. Briggs: Mr. Crozier's plan of filling spaces among potatoes with dry earth in storing is excellent. It prevents shrivelling and enables us to keep our cellars much cooler without danger of freezing

Mr. Green: I would like to know as to the red stripe or streak in potatoes as productive of disease.

Mr. Crozier: The red streak is not a disease nor caused by fungus. It is simply a coloration often present in enfeebled plants.

Mr. Alward: Does Mr. C. advise cutting the top to check the rot?

Mr Crozier: It might under particular circumstances, but I should prefer digging at once.

Mr. Beaumont: How much seed should we plant to a hill?

Mr. Crozier: Two eyes to a hill, hills 3 feet apart.

Mr. Clark: What part of the potato do you use for seed?

Mr. Crozier: I use the seed end in preference to any part, though every part of the potato is good.

Mr. Cunningham: I have best success by rejecting the seed end, and planting two pieces in a hill.

Mr. Alward: Some time ago in Canada a man sold for $5 a secret receipt to cure potato rot. It was to mow the tops when the rot appeared. The result was, there were neither rot nor potatoes.

At the Institute at East Saginaw this subject was discussed as follows:—

Mr. Ure being asked as to his experience in potato growing, said: I have raised Beauty of Hebron for 7 years past, and think it fully equal in value to any other variety. It is earlier than Early Rose and keeps well till June. It is difficult to get true seed. The variety seems to be gradually changing its color, and now hardly looks like the same potato that it was originally. I have a piece of land that has had potatoes on it every year for 37 years past, and can tell by their looks potatoes grown on that piece from others grown on adjoining land from identical seed.

President Willits: Were you troubled with potato rot this year?

Mr. Ure: Not where the ground was well drained. In depressions on clay loam soil with clay subsoil we had some rot.

Mr. Bow: I have tested the question of hilling up as a protection against rot by hilling part of a field and leaving part level. Those not hilled were larger and yielded more, but had one-third spoiled by rot, which did not affect those that were hilled. In my level culture the potatoes were so large that many protruded from the soil and were sunburned, and many of them were red streaked and soggy.

Mr. Fischer: I dig my potatoes when the tops are green and my customers like them and ask to have same kinds again. Dug early they keep better, and are less subject to decay than when left too long before digging. Potatoes vary greatly according to the soil and manure. In 1876 I procured a barrel of Early Vermont, and three of us planted one bushel each. I grew mine on a clay soil with pine sawdust manure from my horse stable, and my potatoes grew so large that they were rejected by the committee at the fair as not being Early Vermont, and one of my neighbors took the prize on potatoes from the same barrel of seed. I think part of the benefit of the sawdust manure was in aerating the soil.

Mr. Webber: I think the effect of sawdust is more mechanical than manurial, and that if boards were spread over the surface equally good results would ensue. I would ask if any one has tried straw culture?

Mr. Fischer: I knew a case of potatoes laid on June grass and covered by one foot of straw, tramped, that killed the June grass and grew a big crop.

Mr. ———: I planted a half acre covered with a foot of straw, but the season was wet and the crop did not grow. This season I planted two acres of undulating land, the low parts black soil, the high parts sandy. The low parts rotted, the high parts are all I have left. When we dug the low ground I only housed the good potatoes and put them one basketful deep over my cellar floor and they have been rotting ever since.

As to fungus coming from leaves, I tried one year mowing the tops as soon as the tops began showing the disease and could see no effect except that the potatoes were less developed.

Pres. Willits: Were your light soil potatoes ripe earlier than the heavy?

Mr. ———: Yes.

Pres. Willits: Isn't that, perhaps, the explanation? As to the mowing, probably the fungus had seeded before the mowing.

Mr. Geddes: I dug 1,700 bushels from six acres, of 35 varieties, chiefly White Elephant, Beauty of Hebron, and White Neshanock. Had no rot. Dug in October. Land is under-drained. Hilled with shovel plow. Plant 3½ feet each way and hill as high as with hoe. Soil is clay loam.

Dr. Kedzie: A good way to treat suspected potatoes is to spread them on the barn floor and sprinkle with fresh slaked lime.

Mr. Webber: Would lime applied to soil have similar effect?

Dr. Kedzie: It would do no harm, but would not keep its caustic condition.

Mr. Webber: Would it not kill the fungus on the tops?

Dr. Kedzie: Possibly.

Mr. Fischer: If to three bushels of potatoes cut for planting you add three quarts of ashes, three quarts of lime and one quart of salt and mix the whole thoroughly you will have no rot. A man in Wisconsin saved his crop by this method when his neighbors lost from one-third to one-half of their crops.

Mr. ———: I think potatoes will mix like corn when raised in the same field.

Mr. Geddes: I differ. Corn mixes from the pollen falling on the silk.

In potatoes this only affects the potato ball and would show itself in a crop raised from these seeds, but not in the potatoes themselves or in a crop raised from the tubers.

HOW SHALL WE IMPROVE OUR COMMON CATTLE?

BY EDWIN PHELPS, OF PONTIAC.

[Read at the Rochester Institute, Feb. 4, 1886.]

This important question, affecting the income of the farmer so vitally, is necessarily of interest to the whole community. We will consider two ways of accomplishing our purpose, neither of which will be satisfactory unless in combination with the other.

Improved methods of handling, with better care and keep, will accomplish very much, but are of themselves too slow without the infusion of new and improved blood. Although I am an earnest advocate of pure bred animals, and would not, willingly, breed any other, yet I say it is more important to give stock good care than to infuse new blood, and the infusion of new and improved blood is, without such care, almost wholly useless. A visit to the average farmer's barnyards will convince one that his stock does not have as good care as is profitable, and while it is better now than when I was a boy, yet there is a great chance for improvement.

I presume most of the older persons here were educated to care for cattle much as I was, viz: To first feed the calf what could be spared of the skim milk for about three months, then turn it out with the herd, perhaps giving a nubbin of corn occasionally the following winter, on the same principle our New England grandmothers gave the boys a piece of pie, the upper crust of which was made with wheat flour, of a Sunday, as a treat. If the calf had sufficient strength the next spring to pull itself out of the miry places, well and good; if not, its hide was taken off and sold for a few shillings. This kind of treatment in substance, was followed through its life; and though during the summer the cattle ranged through the woods and generally got sleek and fat by fall, yet they would in the course of the following winter, running at the straw stack, lose much of their weight and all of their fat, so that when full grown they would not bring enough to pay for even this poor care.

A case in point. A blacksmith in a village, having a favorite cow with a heifer calf, fed it fairly well the first summer and then hired a farmer to let it run with his herd until it became a cow, agreeing to pay 25 cents per week for its care and keep in winter, and nothing for summer. When three years old, although an average good one, it would not sell for enough to pay the bill. He concluded he had better buy his cows in future, and I venture the assertion, that nine out of every ten of the cattle raised in this State do not pay their owners for their care and keep.

I will now briefly give you my plan for stopping the waste. First, give your calf enough food adapted to its wants to keep it growing, the faster the better, never allowing it to stop for even one day, and if you find it is not a good feeder, as some few are not, being naturally delicate or dainty, sell it to the butcher or eat it yourself, and you will find some profit; but if it responds (as it generally will) to your generous treatment, follow it up and see that it does not want for anything as long as it lives with you; you can always sell it at a profit, besides having the satisfaction of viewing and showing your friends the contented, sleek beast, which I know you can have.

The truism, a liberal hand maketh rich, is especially true in this connection. Illustrations might be cited in any number, but I will only call your attention to a few in our own neighborhood. A man in Oakland by the name of Sherman (he may be here) sold to a butcher three yearling steers that weighed over 1,000 pounds each, receiving over $50 for each. Who says that didn't pay? and upon inquiry I found them but common grades. Mr. Tinkin, of this town, can convince the most skeptical that good care pays, having furnished some five young beeves for your market, and at your fairs shown what good care would produce, besides selling two grades for $100 and $90 respectively, when, if they had been handled in the ordinary way, they would not have been worth $25 each. Two farmers of this county had some calves of the same breeding and about equal individual merit, dropped in the spring. One, by good care and generous feed, was enabled to sell his at $50 each, the buyer refusing to take those raised by the other man at $20 each (although he wanted more animals), saying that he would be ashamed to take them home, and they were finally sold in April for $15 each, while the best were sold in January before, thus saving about three months' feed.

The fact is apparent that it never did pay to keep stock in the careless manner so generally in vogue in the early settlement of this county and practiced by many yet.

The scrub must go. The time has come when, with our high-priced land and the sharp competition of the West, we must produce something good or go out of the business. I have pointed out the way to partial success; a higher plane may be reached by the infusion of improved blood. Having first determined upon taking good care of our stock, we look about to see if we can't find something better than we have.

Shorthorns are grand, and Herefords are fine and contend strongly for first place, and sometimes get there, as witness the result at the last Fat Stock Show. Holstein-Friesians are wonderful milkers and good feeders and are claimed to be the all-purpose animal of the country. Aberdeen Angus are hardy, valuable animals. Jerseys produce gilt-edged butter. Ayreshires are good milkers. The symmetrical little Devons are hardy and useful for work, butter or beef, and several other breeds are claiming attention, and any or all of these are a decided improvement over the scrub. But which shall we choose? the one whose form pleases our fancy the best, or shall we investigate the subject farther and see if we can learn which will make us the most money, that being the prime object in breeding? Men rarely keep cattle as pets simply, but for the money they can make.

I am not here to advocate any particular breed of cattle, nor to make war upon any but the scrub.

Who can doubt that improved stock will pay, when on every side are farmers who are making it pay, and when more are going into it every year and never one turns back. Not an instance of failure.

There have been men who have made a failure of farming, even with improved stock; but their failures have not been due in any sense to the improved stock.

Good breeding, good feeding, comfortable quarters, careful handling and kind treatment, all combined, are indispensable factors in profitable stock growing.

Mr. Gibbons being called on, said: Mr. Chairman, I would rather hear from practical cattle men than speak myself. My theories lack the test of practice, but my observation through the State is in favor of the views expressed in the paper. Good stock not only makes bigger profits but makes bigger men, broader men, better business men, men whose ideas don't wholly come out of the ground.

Mr. Yates: In 1844 the Hereford cattle were first heard of in this country, when Sotham and Erastus Corning of Albany, introduced them. Then for a while they were thrown in the shade till 1870, when they came again into popular notice, and from that time they have increased in popular favor, and now nothing can stop them. They are the only well defined breed that holds its characteristics through its grades for four or five generations. The Shorthorns cannot do this; they have no well defined marks to distinguish them.

Mr. Phillips: Did Mr. Yates ever raise any Shorthorns?

Mr. Yates: Yes; in 1832. My father was a Shorthorn man then.

Mr. Peabody: One of the best ways of determining the value of our stock is shown in our stock shows where, in judging, they use the test of performance. We must select our breed by what we want to accomplish, e. g., I wanted butter and selected a breed accordingly, and have since received 30 cents per lb. for my product. Furthermore, having spent a good deal of money to get our animals we have been willing to spend enough money to make the most of them.

Mr. Phillips: What is Mr. Peabody's breed?

Mr. Peabody: It is the kind that your Dutchman eats on toast.

Mr. Phillips: I will give a $100 bull calf to anybody who will raise a Jersey animal that will produce more good meat than my Dutchman can eat at one meal, provided he doesn't have to pay for it.

Mr. J. Martin Wilcox: In one respect the paper hit the mark, viz., care. If you don't care for a thing you won't get anything from it. Whence are our scrubs? From originally good animals degenerated for want of proper care.

Whether it pays or not I don't know. I presume if the actual cost of feeding some of these fancy steers were counted there would not be much profit.

Mr. Phelps: I wished to draw out discussion of the question of profit. I claim that five dollars' worth of feed given a year, over and above the ordinary care or ordinary feed that an animal has, will return double. In some of the bad cases that I mentioned, if they had had even five dollars' worth more feed than they did, instead of bringing fifteen dollars apiece, the animals would have brought thirty dollars. Now I ask any farmer if it pays to just keep the animal alive? The only way I can make it pay is to have it progress right from the start until it is disposed of. I go out among the farmers of the town of Avon, and I find hundreds that will carry their cattle through the winter and then get $15 or $20 apiece for them. Their cattle are well enough bred to make beef without any trouble if they will only give them the feed, but they expect to sell all their grain and keep the animals on the straw stack; or they feed grain and then water them through a half-chopped hole in the ice and leave them out shivering in the winter wind for hours at a time, and then wonder at getting no profits. It is the poorest kind of policy to sell off all your grain and starve your cattle. I am an advocate of thoroughbred cattle, but I would not sell to a man who I thought would not take good care of an animal.

Mr. VanHoosen: I agree with most of the speakers except Mr. Yates, who thinks that the Herefords are the only good animals. I think they are good beef cattle, but there are many other good cattle. I am an advocate of Shorthorn cattle. They are a good beef cattle, good dairy cattle, good for milk and butter, good for all purposes. They are *the* cattle, but as the paper says, they want to be well cared for. If they are not well cared for, they will not pay. If it pays to keep cattle at all, it pays to keep them well. I saw once an account of a man that tried an experiment with two pigs, just of a size and age. He fed one pig just enough to keep it alive, in good squealing order; the other he fed just one pound more a day. It was wonderful to see how it grew. So you see, as Mr. Phelps said, it is the last pound that does the good. It takes just so much to sustain nature, after that the food goes to flesh and growth. Now I think it becomes all of us farmers to keep fewer animals and keep them better.

Mr. Graham: Feeding animals *to make them grow pays*, but to merely keep them alive has no profit in it. A ton of hay worth $12, will just keep a 2-year-old alive through the winter without increasing his weight, and unless the market has raised so that our animal is worth more per pound, we are out of pocket just $12.00 and our trouble. I have found that any animal that is kept on barely enough to sustain life becomes stunted, the growth is stopped, as one man said about his pigs, they get a shell on them and it takes more food to start them growing again. A poorly fed animal does not grow well shaped. He is raw-boned, big-headed, sharp-nosed. Add a few more bushels to the ration and it will make the profit. I can just keep an animal alive this winter at the cost of summer pasture. Add three cents per day of grain and you add from five to fifteen cents per day value.

Mr. Beaker: I can not starve an animal fat. It takes a certain amount to keep up animal heat; what is added to this is the first profit. If the animal will eat ten quarts of meal a day extra it is so much profit. I have raised much stock and the nearer thoroughbred I have them the more profit I find. A bushel of grain fed I consider equal to one dollar in the value of the animal. My experience supports this. I prefer ground feed.

Mr. David Randall: When I feed an animal that does not gain I lose my feed, for it takes him three or four months to get a fresh start. Keeping stock in good shape through winter insures rapid gain in spring.

Mr. Norton: I would like to hear from the stock growers that are interested and find out which breed is the best. If Mr. Phillips has the best I want him to show why. If Mr. Graham has the best I want to know it and to know why If Mr. Phelps has the best I should like to know it. And if we have got to come down to those little Jerseys, I want to know that too. (Laughter.) In the Chicago fat stock show the Herefords took the prize. All animals have to go finally to the block, and there is the test.

Mr. Bartlett: Mr. Norton says the block is the test of value. I object to that. The cow that gives milk for 10 years, even if worth not more than $25 at the end of that time, has been a more profitable animal than the $100 bullock. Of cows the value is in their lifetime.

Mr. Phillips: I believe the prize animal at Chicago was only half Hereford and quarter Shorthorn. Last year a Shorthorn took the prize, dead and alive.

Mr. Phelps: Some one said Herefords had to be fed heavily to make them good. I once called on Mr. Sanford Howard, then Secretary of the State Board of Agriculture, a man of most excellent judgment in stock. He said the Herefords are essentially poor men's cattle, *i. e.*, they will prove profitable even though neglected.

Mr. Phillips: I agree with Mr. Howard, they are the poor man's cattle, and the man who raises them always will be poor.

Mr. Willits: In reading the program I was misled as to the subject. "How shall we improve our common cattle," I thought meant our native cattle. But you have been talking about thoroughbreds here and have got it so fine that common cattle means improved stock. The discussion has been limited to that direction. I was in hopes that Mr. Norton would try to give us some points about common cattle, as I conclude from what he said that he had nothing but native stock, and as he seems to have good stock, why is it that he does not run for Shorthorns and Herefords? Is it because he is afraid of paying Mr. Graham the two hundred dollars? I think Mr. Norton can see a possible profit as quick as any of us. Would it not be possible for us to take our native stock and improve that just as this improved stock has been improved? What is the Shorthorn but improved common stock? Improved for years by selecting the best points and transmitting them. Now I am free to say I have a little national pride. I would like, if possible, to raise up some American stock; something that wasn't Jersey or Holstein. Why can't America, by persistent selection of the best and breeding from them, develop an American stock that shall be as good as other things American?

We have broad plains and fertile soil. Cannot they grow a good thing? You may say, it is not possible, because even our native stock was originally imported. We haven't anything but what was imported. Did it have the same points the Holstein had or the Ayrshire? What has become of those points? There is a queer fact in reference to a transmission of quality. You can take these scrubs and in a few generations raise them head and shoulder above the common stock. Jersey stock was developed on an island and they didn't import any. There was a law against importing and they improved on what they had.

Do you say, "What is the use of beginning all over again when we have the opportunity of starting where our predecessors left off—of beginning at the top of their achievements?" But how do you know but the native stock will develop a quality better than the imported. Have you tried it?

On this question of the relative merits of the different breeds as beef makers, the State Board of Agriculture have directed Prof. Johnson to procure two calves of each of the leading breeds, of as near the same age and condition as may be and feed them for three years, treating all alike, and at the end of that time comparing results.

Mr. Ball being called upon, said: As to President Willits' question, why we do not try to develop a native breed, I think he answered it partially himself. The reason is that the object of breeding is profit. It is cheaper to buy improvements than to make them, and the breeds are already far advanced in development. There is no use in going back to the bottom and working up again from the beginning. Life is too short to try to make thoroughbreds from natives. It is hard for any man to handle common cattle because they are disagreeable to look at, unprofitable to feed, unprofitable to keep and do not do anybody any special good. Now, so far as the imported cattle being better than the cattle of this country is concerned, it is not true; people import cattle as they import anything else, to make a great noise about it; to get a high-sounding pedigree; also, perhaps, to make money out of it. That our common cattle have been improved by importations of foreign cattle is true, but the time for that has gone by. It is not necessary now to go Great Britain or anywhere else. We have the very best. We have exported a large number of improved cattle to England of late years. It works backwards and forwards. Every farmer should take the best he has and use the best sires he has access to, whether Hereford or Shorthorn.

THE DAIRY.

BY GEORGE SINCLAIR.

[Read before the Hudsonville Institute, Feb. 3, 1886.]

This subject is one in which much capital is invested, and to make the business pay one has to give it the closest study.

1. We have the cow. She must change the feed into milk. The cow may be compared to an engine and the feed to the fuel. Now, if the engine has only enough fuel to overcome friction you get no power, or if you use the fuel to overcome the friction in two machines which could be used in one you lose time and fuel, but if you use this in one machine you realize a profit. The same with a cow. We are told that it takes two-thirds of what a cow eats to sustain the system, one-third to produce the milk. The less a cow has to travel to get her feed the greater amount of milk per pound of feed.

I have thought many times when I have seen cows hurried by men, boys and dogs whether the owner ever considered the cost.

2. The feed and surroundings.

The cow is like a filter. If you over tax it by giving poor feed you soon wear it out; besides producing a poor article of milk, butter and cheese.

I believe the seeds of poisoned cheese are sown in letting the cow drink stagnant water, eat fermented food, or breathe foul air. This much we do know, that the best grades of milk products are made where the feed, water and air are of the purest.

3. The care of milk. It is essential that milk should be well aired and cooled as soon as milked to stop the tainting or decomposing. See that the udder is well cleaned before commencing to milk, and do not wet your hands so they will drip in the pail.

How much milk should a cow give? There are records as high as 18,000 lbs. of milk per cow in one year, but the farmer can get a dairy which will average 6,000 lbs. per cow, and he will not see the difference in cost of keeping between it and one which gives only 4,000 or 3,500 per cow. Old dairymen in the east made cheese for 3 and 4 cents per pound years ago, and the best of them say they would not keep a cow which would not make 600 lbs. of cheese in one season. Now the average at most factories does not exceed 350. At a factory in northeast Ohio, at the yearly meeting, the best and poorest dairy were compared, with the idea of stimulating the patrons to improve their dairies and care of them. The best dairy of 14 cows had received from the factory during the year an average of $50 per cow, while the poorest one of 10 cows had received only $27 per cow.

The dairy well solves the question as to what to do with our farms. Grain raising exhausts the land by always taking from it and returning nothing to it, while in raising stock for beef, we find ourselves in competition with the West, where it costs but $4 to raise an animal of 1,200 pounds weight.

At Elgin, Ill., 15 years ago the farmers had run their farms out by raising grain. They turned their attention to dairying, and to-day there is not a more prosperous section of farming country anywhere.

Prof. Beal: We hear much of butter substitutes and the efforts to check them. It seems to me that making a uniform grade of excellent butter in factories is the true solution. Further, it is an immense relief to the pressure in the household. Factories make butter at 4 cents per pound plus cost of cream

Mr. Beaumont: I would like to know the figures of western factory dairying.

Mr. Sinclair: In November, at Elgin, Ills., net $1.60 per cwt. of milk, December $1.61, January $1.60, February $1.63 per cwt., on the co-operative plan, dividends paid in thirty days. Another factory paid $1.44 for the last half of December. Some factories, not co-operative, pay $1.25 per cwt., as the markets are running now. Butter at Elgin is now 33 cents, has been 40 and 41 cents.

Butterine men there have to have creamery butter to make their product. Creamery butter in Chicago is now 30 cents.

Prof. Johnson: How many pounds butter per cwt. milk?

Mr. Sinclair: 3.8 lbs. on the average by setting the milk, or by the centrifugal separating process 4¼ lbs.

Mr. Clark: I have little experience. I use the Flint creamer, the Wilson churn and a roller butter worker. We milk twenty Jerseys. I connect the creamer by pipe with my well, the water from which is raised by windmill. If wind fails we need ice. An ice house 14x16 costs very little and a farmer's supply of ice can be put in in the off times during the winter at very slight cost. Creamers give skim milk for feeding stock at home and secure better price for cream. My plan is furnishing butter direct to special customers and I am able to get 25 cents per pound. I set out milk for so long as I please, a shorter time when the calves are young, so as to leave more richness for them when they need it, and longer as the calves grow older.

The dairy is the hope of our farms. Butterine will not be a formidable competitor when people realize what it is made of or when real butter is *uniformly* well made, so that consumers can be sure that real butter will be good butter. When all farmers' wives use the best improved methods and make good butter, all consumers will afford real butter. I am told there are six grades of butterine, the best grade being 50 or 55 per cent creamery, that is, the more butter the better butterine.

Mr. Sinclair : Did you ever weigh your milk into your creamer and test the difference in use of ice or water ?

Mr. Clark : Our well water from seventy feet deep gives my best results whenever the wind holds. I tested three cows as to butter yield, but I have not the figures at hand.

Mr. Sinclair : The Illinois factory had always used 48° well water in winter. I suggested river water at 32° from 125 feet distant. This increased the butter yield ½ pound per cwt. of milk. Ice is better than well water. In deep setting the be-t temperature is 37° and this is gained by setting in ice baths. Milk 18 inches deep is the practice at Elgin.

Prof. Johnson : " Deep setting " so called is deep in open vessels, while the Cooley Creamer is deep in a closed and submerged vessel and the Superintendent of the Farmington, Connecticut, creamery says that the former gives one pound of butter to 30 pounds of milk, the latter one pound of butter from 21 pounds of milk.

Mr. Sinclair : At the Elgin factories 24 cents per cwt. is allowed for skim milk and farmers can better sell at that figure and buy feed for their cattle with the proceeds.

Mr. Norton : Are the best results gained from Cooley Creamer by setting 12 hours or 24 hours ?

Mr. Clark : My people tried drawing milk off at 12 hours, but found that we did not in that time get all the cream.

Mr. Chamberlain : With ice, 12 hours is long enough, without ice not. Just so long as the milk is cooling, just so long and no longer is the cream in rising.

President Willits : This discussion has brought out the point that ice is neeeded to produce uniform results. The temperature of well water is too variable or not low enough.

OLEOMARGARINE AND BUTTERINE—WHAT SHALL FARMERS DO ABOUT IT?

BY CHARLES ADAMS.

[Read at the Rochester Institute, February 5, 1886.]

After quoting Mr. F. S. Kedzie's description of the method of manufacture of these substances, as given on pages 169 and 170 of the Report of the Board of Agriculture for 1884, the speaker read the following extract from the *N. Y. Times* of January 20, 1886:—

INGREDIENTS OF OLEOMARGARINE.

"ALBANY, N. Y., January 15.—The annual report of Dairy Commissioner

Josiah K. Brown, for 1886 says that there has been paid into the State treasury during the past year on account of fines for violation of the dairy laws, more particularly those relating to the manufacture and sale of oleomargarine, $2,288.81. Comr. Brown says he has been somewhat retarded in his work by the adverse decisions of the courts, as in what is known as the Marx case, in which it was held that the law prohibiting the sale and manufacture of oleaginous substances, other than that made from pure milk or cream, and designed to take the place of butter, was unconstitutional. 'This decision,' he says, 'has worked to the disadvantage of those who have been anxious to suppress the sale of spurious articles of the character mentioned. Dealers in imitations have in many instances boldly defied even the laws that are, beyond question, valid. Notwithstanding these obstacles much has been done to bring offenders to justice. There are now upwards of 200 cases in the courts. Many careful tests have been and are constantly being made throughout the State, which fully sustain the correctness of the milk standard established by the acts of 1884. Although the sale of imitation butter has been reduced in this State the sales in the United States, as a whole, have materially increased since 1883. The report includes a paper from Dr. R. D. Clark, of this city, who gives it as his opinion that oleomargarine is dangerous to health because it is indigestible, is insoluble when made from animal fats, and is liable to carry the germs of disease into the human system, and because in the eagerness of the manufacturers to produce the spurious compound cheaply, ingredients enter into it which are detrimental to the last degree to the consumer's health.' "

Appleton's Encyclopedia says:—"Oleomargarine, strictly speaking, is not butter, but is the butter fat obtained from beef fat according to the Mège process; while oleomargarine butter, or butterine, is the product of churning oleomargarine with milk, thus converting it into butter." Dr. Henry A. Mott has made an elaborate analysis of oleomargarine, from which it appears that its constituents are:—

Water	11.203
Butter solids	88.797
	100.

The constituents of cream butter are:—

Water	11.968
Butter solids	88.032
	100.

Thus it seems plain that every element which enters into the composition of the best dairy butter is to be found in oleomargarine butter, and no element is present in the latter which is not present in the former. The only difference between the two products is in the proportion of volatile fats which give the aroma and flavor to butter, and at the same time decompose and render the product rancid. The amount of these volatile fats in oleomargarine butter is sufficient to give to the product the so much prized flavor and odor, but not sufficient when decomposed to make the product rancid; and for this reason oleomargarine butter keeps sweet and pure for a much longer period than dairy butter.

At the works of the Commercial Manufacturing Co., New York, 50,000 pounds of butter are made daily, all of which finds a ready sale, the price ranging from 15 cents to 22 cents, according to the season and to the form in which it is put up. By law, every tub or package of butter sold must be branded "Oleomargarine Butter." To make about 50,000 pounds of butter a day it is necessary to use 122,000 pounds of fat a night. Profit per day, $265.82.

On the question "What shall farmers do about it?" Mr. Adams quoted our State laws on the subject, enacted in 1881, which are given in full on pages 172 and 173 of the Michigan Board of Agriculture for 1884, and says: I think that these penalties are too light. They should be doubled; and unless there is speedy reform they should be trebled. The more severe the penalty the less violation of the law. Let the penalty for murder be death and fewer murders will be committed. Since writing the foregoing I have received lines from Chicago and Detroit, as follows:

CHICAGO, January 29, 1886.

Yours of 27th at hand. Contents noted, and in reply would say that I will give you the prices on butterine, etc., as near as I can.

Choice Creamery	Butter,	pure,	selling		28 @ 32
Fair	"	"	"	"	20 @ 28
Choice Dairy		"	"	"	15 @ 25
Fair	"	"	"	"	10 @ 15
Low Grade, poor					07 @ 09

I am selling a fine article of extra dairy butterine here for 15 cents. It is nice stock, most everybody is selling it for pure butter here. Prints and rolls also 15c. We have a cheaper grade for 13; good stock also, and even lower price, 12@12½.

Yours Respectfully,
CONGLE BROS.

DETROIT, January 27, 1886.

Oleomargarine is manufactured from beef fat, while butterine is from 25 to 60 per cent new, sweet butter, churned in new buttermilk with oleomargarine and ranges in price from 12 to 15 cents wholesale. The quantity of butter used determines the price. D. O. Wiley & Co. of this city probably wholesale more than any firm in the city. I would very much prefer a good article of butterine to a medium or poor quality of butter for my own use. We sold 3,300 pounds summer butter for soap making at 2½ cents per pound. We are glutted on butter and could make no price.

Yours,
J. Q. WILLIAMS.

If this statement is correct then it is very plain that when butterine is made 25 or 60 lbs in every hundred is of new sweet butter, and in my opinion every pound of this new sweet butter is spoiled. Pass a stringent law against the manufacture of all such stuff. Prevent the making and then you will do the best to protect all consumers of butter.

One way to annihilate oleomargarine and butterine is to raise the standard of real butter, and thus prevent all and every excuse for inventing substitutes. Have a butter inspector appointed by government and let no butter be merchantable unless it has the stamp of this inspector. Butter may be inspected as well as salt, pork, etc. I once offered about $400 worth of pork in Detroit and the dealer said: "I will give nothing for it unless it bears inspection." It all bore inspection but a barrel of heads, and that, like poor butter, went to make soap. One way for farmers to do about butter when it does not pay to make it, is to quit the business as they do when potatoes, pork, etc., are very low in price and the market glutted, and let farmers' wives have a long rest from the hard work of butter making. Let butter buyers and butter eaters have olemargarine and butterine to their hearts' content. Finally, farmers should use their combined influence against worthless and demoralizing substitutes for the real and the good.

Mr. Lawson: Mr. Adams recommends the stamping of butter by a government inspector. The government stamp could not keep it from spoiling nor guarantee to the purchaser anything more than that the article was orignally good butter.

Mr. Adams: Butter inspection will last as long as pork inspection.

Mr. P. D. Lerich, of Utica: Let us not get excited over this subject. We sell the material for either butter or oleomargarine. Oleomargarine may not be as good as some butters, but it certainly never got as low as the 2½ cent article. We must fight oleomargarine, not with laws but with better butter. These manufacturers make a large market for our suet and make it good and valuable. We need not be afraid of the competition of their product if our butter is good enough. The best butter brings 30 cents a pound to-day in spite of butterine. Many farmers fearing they will lose a little cream leave it on the milk till almost rotten and then try to counteract this by poisoning it with salt.

Mr Wm. Graham: When we remember that we have 55,000,000 people and 13,000,000 milch cattle we will find that there is not enough butter to go round. There was a demand for more good butter and oleomargarine supplied this demand. To-day the best butters bring 30 cents per pound. It is not every one who can afford this price. When butter was 40 cents per pound I have seen those who could not afford that price buy lard at 7 to 14 cents per pound, and use that instead of butter. While talking about inspection and government stamps, what stamps would you put on much farmers' butter that is only fit for axle grease? We are a free people and have a right to buy a cheaper article when it is good. It is not the best butter makers that are complaining; many butter makers get 40 cents per pound for all their butter.

Prof. Carpenter: I think farmers have a right to complain. The Lansing butterine works went into business as a creamery establishment and made 5,000 or 6,000 pounds of butter per day and sold at 25 cents till detected. They furnished me with "pure butter" for upwards of a year before I discovered that I had been eating oleomargarine or butterine instead. I did not know the difference, yet didn't like to be imposed upon. Farmers may demand that butterine shall be sold under its own name.

Mr. Yates: In Chicago Mr. Armour proved that the premium Iowa creamery butter was made of his butterine.

Rev. I. P. Donelson: Mr. Graham is a grower of Shorthorns and admits that his Shorthorns are not equal to the occasion in the demand for butter, and so he is anxious to boom a market for Shorthorn fat. The true solution is, as said, partly in the production of better butter and more of it, and this will be done by raising more cows and the establishment of creameries. We must raise more Jerseys and fewer Shorthorns.

Hon. J. H. Holman: Last April 1st my landlord at Lansing passed off butterine on me and I didn't know it. Some one said if you make good butter you will increase the demand. This is wrond end to. The demand makes the supply. You talk of inspection. You stamp the pail, but the dealer destroys the stamp, and then what? The innocent user is defrauded. In New York they found the only remedy to be complete prohibition of the manufacture and sale. Anything short of this leaves innocent people, boarders, laborers in lumber camps, etc., to eat butterine. I can't afford 35 cent butter. What I want is better and cheaper pure butter.

THE RELATION OF VETERINARY SCIENCE TO AGRICULTURE.

BY PROF. E. A. A. GRANGE.

[Read at the Rochester and East Saginaw Institutes.]

Mr. Chairman, Ladies and Gentlemen:

As the people of this State have from time to time been addressed by the different chairs of the Agricultural College in reference to their connection with the profession from which the institution takes its name, I have thought that at this time it might be well for the new department of veterinary to arise and explain its relation to this important calling. I call this a new department because this is the first year it has been recognized by the the Legislature of Michigan, although it has been growing for some time; beginning, I believe, with a few scattered lectures. These taking root, however, grew into a six weeks' course, which after two summers developed into a full term study which, in turn, branched into a course of lectures, extending through the entire college year; and this is the condition of the department now But without speaking in metaphorical language and calling it a twin sister or a first cousin to its neighbor, I may say that the two professions are related in more ways than one, and it is concerning these that I wish to say a few words to-day. Although there may be some here who at first will think, why, every one knows that to cure a sick animal is a good thing for a farmer to be able to do, and to them an address bearing upon this subject may appear superfluous, indeed I felt a little that way myself when I first thought of speaking upon the relation of veterinary science to agriculture, but upon reflection I think it will appear evident to those who have any knowledge of the two professions that the mere pouring down of appropriate remedies in the treatment of certain disorders is not the only or even the principal feature through which they are connected, and bearing this fact in mind I hope to suggest something that will cause you to think of these two sciences in more intimate relationship, and of more importance to one another than you have done in the past.

In arranging my platform for action I have thought it advisable to take up the different branches of the subject in about the same order that we follow in our course of lectures at the college, for by so doing we will kill two birds with one stone; in other words, it will give you some idea how veterinary is taught at the college, and at the same time will show the relation of the individual subjects to agriculture separately. We begin our course with the study of veterinary anatomy; here we take the animal to pieces as it were, and learn how the different parts are made, observing carefully their relations to one another, their situation, the uses they are intended for, and their appearance in health. We also observe the defects in many instances which occur in weakly constructed parts, and by becoming familiar with these subjects, surely one is more likely to observe their presence or absence, as the case may be, when making a purchase, or judging the comparative value of several animals.

Take for example the study of those levers of progression, more familiarly called muscles, which perform the many and eccentric movements of the body. Here is a branch of anatomy we all consider of great importance in our course; and little wonder, for by being conversant with the attachment, with the actions, the relations and shape of the 312 muscles which go to make up what we commonly call the flesh or meat of an animal, we are in the possession of the knowledge of a subject which I might almost say is invaluable to the stock raiser, for they are among the main features by which we judge an animal's parts. I dare say many of you have heard the connoisseur in horse flesh say: "I like to judge a horse when he's middling low in condition," and if asked why, will probably reply: "Because I can tell better what he is made of." As this must refer largely to the muscles, then will it not be advantageous for us to train ourselves as to their appearance, as well as to know something about their structure and movements beneath the skin? Now if the animal is high in condition—fat, as we generally say—their outline will be hidden to such an extent that we cannot see them plainly. The reason, then, why a good judge prefers to examine a lean horse is obvious. Again the framework upon which the organs are built plays an important part in the make-up of the creature, and we learn by observation what style of conformation is best adapted to our wants, we learn further what kind of joints are most subject to those frequent "bug-bears," ring-bone, spavin, and the like. Passing down the leg we at length come to that very important and interesting part, the foot, whose relation to agriculture, or indeed any other calling in which horse-flesh is concerned, is most intimate, for the diseases of it are not only numerous, but they are sometimes very serious, even causing the death of the animal. I have known several instances where animals have died from picking up a nail, and lock-jaw is not at all an uncommon result of the same accident. Indeed, of such importance is the shape and durability of the foot, that I presume nearly every one here has heard that threadbare expression, "No foot, no horse;" but who this happy thought first occurred to I am unable to say. It no doubt originated many hundreds of years ago when people did their traveling upon horse back, and not as we do, in Pullman cars and floating palaces. At this time the pack-horse, being required for long journeys, if he had not a well-shaped, tough hoof, would in a short time become so foot sore that he would be unable to proceed on his journey; so the equestrian finding that his horse's foot was worn out, gone as it were, might he not appropriately exclaim: "No foot, no horse," and have to come down to shank's mare for the rest of the trip. And even to-day I hear men say, "I'll never have another flat-footed horse," while their neighbors will exclaim, perhaps with increased emphasism, "I've owned the last deep-walled horse I'll ever own." We learn why these features are objectionable or the reverse, in the study of that part of anatomy called pedology, or the science which treats of the foot.

Passing from this to the deeper seated structures we study the functions and general appearances of the internal organs. By knowing something of their peculiarities we are able to judge to some extent of the merits of an animal. Take the chest, for instance, we know from experience, other things being equal, that the deep chested horse is better adapted for speed than the one which is broad and somewhat rounder. And why is this so? But to answer this we have to go to the dissecting room, and there we will find upon examination that the breathing surface of the lungs is increased in the deep chest without expense to the graceful movements of the forelegs, as it would be, were they spread apart by a broad chest. It is a singular fact that the shape of the chest has a somewhat close relation to the kind of work nature has intended the animal to perform. For a familiar example of this we have only to compare the chest of the greyhound to that of his more surly neighbor, the bulldog. Then again, by being familiar with the various movements of the circulations, we are enabled to judge of the health of an animal. By careful study of the appearance of the skin and its numerous glands we can also judge in many instances of the constitutional condition of the creature. In fact, I may say that there is no organ or group of organs whose normal or abnormal, healthy or unhealthy condition is not of importance to the live stock merchant, be he breeder, dealer or casual owner, and I felt warranted in saying that the more anatomy the practical man knows the better judge he will be of the living creature, either in the show ring or upon the roadside.

As I have no doubt there are some here who would like to know how we propose to teach this important branch of veterinary science at the college, I may say that through the liberality of the last legislature this division of our study is well equipped, for our anatomical museum contains a skeleton of the horse, ox, sheep and hog, giving all the material necessary for discussing in a somewhat practical manner, the hard tissues of the body. For the muscles and other soft tissues, we have that beautiful model of the horse, prepared with the greatest care for correctness, by the late Dr. Anyaux, of Paris. This model stands four feet three inches high, is made so as to separate into ninety-seven pieces, and exhibits over 3,000 of the most important anatomical specimens of the animal, among which may be mentioned the superficial muscles, nerves and blood vessels on one side, the other side being arranged so as to remove layer after layer down to the skeleton. The brain, the eye, the foot, lungs, bowels, kidneys, and all other important organs are also arranged so that they can be studied as well, if not better, than in the natural subject; I mean, of course, when our time is somewhat limited. We have other models and natural preparations which are perhaps not necessary to mention. Besides studying the subject from prepared models and skeletons we propose to study the horse, at least, from the original animal, and for this purpose we have a very nice dissecting room adjoining our museum, large enough to hold three subjects at one time, and where we can take in the organs of any animal we choose. While speaking of the form of the horse as related to agriculture, I may here say that later on in our course we propose to take up the external formation of the animal, both theoretically and practically. The former we do in the lecture room, points being illustrated by diagrams; the latter will be done in a large room, intended among other things for this purpose, and where we can take in several animals at a time and go over them in a careful manner, discussing each point in its turn and make a comparison of it, side by side with other living creatures. We spend several days at this kind of work, for I look upon it as one of the most interesting and perhaps useful groups of lectures in our course, and on anatomy as the foundation of our study. Allowing, then, that veterinary and agriculture are related through the anatomy of the former, it will not be difficult to trace a close relationship of the two sciences through the accidents and maladies which threaten, and in many instances cause the death of our often most important means of support.

So it is almost unnecessary for me to say that any art, profession, or science which has for its main object the investigation of the causes of these maladies, as well as the remedies which are calculated to overcome their evil influences, has a very important relation to agriculture; and at this point I dare say I will be pardoned if I just briefly allude to the early history of veterinary medicine, to show how the profession has from time to time advanced in public estimation by gathering knowledge for the alleviation of pain and the destruction of the active principles of disease; but will not go back farther than the eighteenth century, for by doing so I would have to take up considerably more time than we have at our disposal, except I may say that before this the treatment of the diseases of lower animals was in the hands of those connected with their immediate care and management—goat-herders, shepherds, and the like— and wh was known with regard to the actions of medicines, existed among those possessing the art of human physic. Indeed we are told that Hippocrates, who flourished about four hundred years before the Christian era, and who has been appropriately named the "Father of Medicine," did not disdain to practice both upon the horse and his rider (people did not drive in those days). The eighteenth century, though, was destined to witness the most important epoch in the annals of veterinary history. About this time epizoötics were rampant, so much so that the agricultural interest of many countries was materially affected by the destruction of their live stock, and people were sadly at a loss to know where to turn for counsel, but the French government, ever in the vanguard in such matters, set the notable example of establishing a school for the purpose of teaching what we commonly call veterinary surgery. (Let me here say that the term veterinary is derived from a Latin adjective, veterinarius, "that which appertains to the beast of burden," but is now intended, of course, to include all domestic or farm animals.) This school, or college, was instituted at Lyons in 1781, and to-day is looked upon as one of the leading schools of the time. A few years later a second school was established at Alfort, near Paris, which is now in high repute. In English-speaking countries the science seemed to be buried in gross ignorance for considerably longer than it was in France, Germany, and other countries, for it was not until the last decade of the eighteenth century that an energetic Frenchman named St. Bel, after a second attempt, was successful in establishing a college in London, and even his efforts the second time would have been defeated had not his proposition been noticed by the Agricultural society of Hampshire, whose most enterprising members became convinced of the great benefit the establishment of such an institution would be to the agriculturist engaged in stock raising, and gave such encouragement to St. Bel's proposition that in 1792 the Veterinary college of London was fairly started. In 1820 the Highland Agricultural society established a similar institution at Edinburgh. Since then veterinary colleges have been established in almost all civilized countries. The fashion now, on this side of the Atlantic at all events, is to have them affiliated with a university or agricultural college. Now when men are required to study an art or science in such a way as to be able to pass an examination before outside examiners, as is the case at veterinary colleges, of course it is necessary that they become familiar with the current literature and other matters connected with that art or science; so that, as year after year rolls on, the profession, through efforts of its members, accumulates an amount of knowledge which would swell a good-sized book shelf. This style of literature contains besides other things, a description of the maladies peculiar to certain countries, their behavior under certain climatic influences, their effects upon different animals under different circumstances, as well as other matters in relation to disease, written by men trained and educated in a systematic manner, which enables them to discuss somewhat intelligently the various topics which are brought under their notice, and by the accretion and dissemination of this kind of information agricultural interests are benefited, and protected to some extent from the evil influences of those contagious and other diseases which have been the subject of so much investigation, both by government experts and private enterprise, and which, with our present system of commerce, would spread far and near were their march not arrested by official restriction. In olden times, let me say, these maladies were chiefly spread by contending armies whose marching and counter-marching would gather and spread the germs of disease often in a most alarming manner; indeed so prevalent were these diseases on such occasions that their immediate cause was thought to be the result of depletion from the fatigue and exposure of a long campaign. To-day we have navies of steamships and armies of railroad cars to take the place of the invading foe—the former to import, the latter to scatter the germs of disease broadcast through the land. Happily for us this wholesale dissemination of virus is in a measure prevented by the establishment of quarantine stations at various ports of entry.

At this point I think it would not be out of place for me to say a word or two in reference to the collection and dissemination in this country of certain knowledge bearing, I may say, immediately upon the relation of veterinary science to agriculture, and perhaps I cannot do so in better terms than by quoting from a recent report of the commissioner of agriculture at Washington, in which he says: The call upon the agricultural department for veterinary investigation has been very great during the past year (1882).

The sudden and unaccountable outbreak of disease among domestic animals has been a matter of great anxiety in many portions of the country.

As the number of our cattle, horses, sheep and swine increases the outbreak of contagious diseases also increases. The annual disturbances, moreover, incident to the work and confinement to which all classes of animals are subjected which are held in immediate domestication, also increase as our population grows more and more dense.

To meet the calls which this state of affairs creates the department has been obliged to depend on such temporary and outside service as could be obtained. The absence of a well organized veterinary division has been severely felt and it is of the utmost importance that such a division should be established in which all investigation can be directed by a competent head and on which the owners of live stock can call for counsel and aid. It is important to know the precise extent of existing disease; it is important to know how to guard against the spread of contagion and how to provide for its removal; it is important to know, if possible, the most economical remedies for disease and how best to avoid the vast annual loss of animals from bad treatment and exposure. It is important, also, to ascertain by the most careful investigation, the breeds best adapted to the different localities and purposes in our country. To do this a well organized division of veterinary inquiry and animal industry is absolutely necessary. I may add that since then this bureau has been established with a veterinarian at its head, among whose duties it is to investigate various diseases which affect our live stock and tell, if possible, what the causes are and the best means to prevent them, as well as the remedies which will overcome their influences when they can be discovered. As an evidence of the good work this bureau is doing I have only to refer to their first annual report. Besides this and during the last year or two, individual states have in many instances established live stock sanitary commissions to combat the advance of contagious disease. Our own state is among the number which have adopted this institution.

Reverting again to our course of lectures at the college and its relation to agriculture, let me once more call attention to some of the commissioner's expressions. First he says: "It is important to know how best to avoid the vast annual loss of animals," to which I may say that as one step in the right direction towards overcoming this evil, we propose at the college to study the causes of disease, and in this connection I think I am right when I say that among the greatest benefits our college course of veterinary science will be to the farmer or stock raiser, is the knowledge a careful student may gain by attention to this branch of pathology. Who has not heard the expression, "An ounce of prevention is worth a pound of cure." Surely this is just the place to apply this adage, but I cannot pass over the causes of disease without reminding you of the important 'role' which these recently discovered germs, bacteria and their allies, play in the wholesale slaughter of ourselves and our animals, and as evidence of what may be done by getting at the root of the evil we have only to recall the great national benefit Pasteur accomplished for France in the restoration of the silk industry by finding out the cause of "Pelrime," the disease which destroyed the silk worm. Since then this man and others of his kind have done much for agriculture and indeed every other pursuit that man is engaged in, by discoveries of the causes of the diseases not only of man and animals, but also of vegetables, and although veterinary science does not pretend to know the causes of all diseases, yet she teaches us in many instances what style of conformation is likely to be affected with certain disorders, what kinds of food are likely to disturb the animal economy and points out many other rocks of animal destruction, by avoiding which our bark is not so likely to be foundered. While trying to make ourselves familiar with the causes of disease, we do not lose sight of the value attendant upon a knowledge of its symptoms, nor do we forget the importance of being able to combat the individual ailments when they do exist. Further, the commissioner says: "It is important to know if possible the most economical remedies for disease." Appreciating this, we introduce into our course the study of materia medica which includes within its province a general description of the drugs or medicines used in a case of disease or for alleviation of pain. In studying and discussing them we direct our attention, among other things, to their actions, their uses and abuses, when certain remedies should be given and when they are contra indicated with other matters relative to the handling of drugs.

If we admit, then, that these two sciences are bound together by the cords of anatomy, etiology, pathology, materia medica and the like, I think we must also admit that there is still another cord, which from a moral point of view is of more importance than any of the others. It is the one which makes veterinary a disciplinary study, for by pursuing it in an intelligent and systematic mannner we cultivate our brains, we train our minds, and thus improve our thinking capabilities, by doing which it at once becomes an important ally to agriculture.

PEACHES FOR PROFIT.

BY PROF. W. H. MERRITT, OF GRASS LAKE.

[Read before the Grass Lake Institute, Feb. 15, 1886.]

That peach culture is a peculiarly fascinating occupation, and, in some places at least, a very profitable one, cannot be gainsaid. And while it cannot be expected that this fruit will ever supplant wheat as a staple, it is known that with favorable conditions, averaging year with year, peaches may be made to yield a greater revenue than almost any other farm product.

You ask me what I mean by "favorable conditions."

I mean the natural circumstances in regard to location, market facilities, and good care, which are necessary in raising any farm product in order to realize the best results.

And of course I do not mean to imply that freedom from insect pests or disease is necessary to make this business profitable. If it were we might as well give over the question, and give up trying to raise any fruits, for it is a general rule that each has its enemies, and their culture its difficulties, and almost in the direct ratio of the importance and value of the fruit.

If there were no drawbacks to peach culture, Delaware and Maryland could have supplied the markets of the whole country, and Michigan would probably have never developed even what she has of her available fruit lands. But even with the great discouragements of the "Yellows," of severe spring frosts, and one-sided location, the peach orchards of those States are still maintained and profitable.

The great increase in the demand for fresh fruits of all kinds in the last few years has opened our eyes to the mine of wealth that lies in the natural resources of our State. In the first place Michigan is centrally located in the United States, within easy reach of the great markets of our country, thus possessing a great advantage over Delaware and California—the extreme east and west, both in the *time* and *expense* of marketing. Secondly, the State is protected from the extremes of heat and cold by the great lakes which nearly surround it; and thirdly, no State has a more intelligent, determined class of citizens to investigate and apply the principles of pomology.

The first question to settle after one has determined upon peach growing is *where* to plant his orchard. This involves considerations of climate, market facilities, soil and drainage, all matters of great importance. The climate of Michigan is so variable that this question at once assumes prominence. The peach is a native of Persia, and is a semi-tropical fruit. In order to raise it profitably in a region so liable to sudden and severe cold, the most favorable places only can be utilized to advantage.

But years of culture in this country have partially acclimated the peach, so that the more hardy varieties have been known to survive 16° below zero, and bear a good crop the following season. It is a well-known fact that nearness to large bodies of water insures a warmer atmosphere in winter and a cooler one in summer. Applying this principle to the matter in hand we will naturally look to those portions of the State lying nearest to the shores of our great lakes as being best suited to this fruit by reason of modified climate. Now, as our prevailing winds are westerly, and as passing over water will warm them, we look to the eastern coast of Lake Michigan as affording the best climatic conditions for peach growing in the State. The facts bear out the theory, and the utilization of that section has rendered famous the fruit belt of Michigan. There or anywhere else, climate is modified by the exact location, and there as elsewhere the hill-tops, or at least high dry lands, are best adapted to our purpose. The peach does not want too much protection, especially from the wind, and always does better on high than on low land, because high ground is generally warmer both as to air and soil.

A peach tree will be injured by cold much quicker if its roots are in a wet, heavy soil than if in one that is dry and porous. Therefore we need to look well to the question of *soil*. Some persons seem to have a fixed conviction that peaches require a light, sandy soil, and that a natural rotation of crops would demand that peaches should be planted after hemlocks. This is altogether a false notion, as a short experience would convince any one. For reasons stated, a dry and somewhat porous soil is preferable, but especially is a porous *subsoil* desirable. If that is found, almost any surface soil may be used to advantage, though for most varieties, and for convenience in tillage, a sandy loam is the best.

Drainage is also an important item in selecting a location. The best of all drainage is the natural absorption of the soil, and if an open or gravelly subsoil can be obtained, no surface or tile drainage will probably be needed.

Where this is necessary, however, the more thoroughly it is done the better it will pay. When tile are used they should be put in with great care and exactness, as it is much cheaper to finish the job at once than to have it to undo and do over again in a few years. The space a tile will drain depends upon the lay of the land, a much greater distance being influenced by tile laid along the foot of a slope than on a level. As the first and main object of the tile is to get the water off the ground as quickly as possible, care should be taken not to lay it too deep,—in most cases an average of two (2) to two and one half (2½) feet being sufficient.

Nearness to market is also an important consideration in selecting a location for a peach orchard. If one is going into business on a large scale he cannot afford to depend on small markets, and the farther a tender fruit has to be carried by rail the less profit there is in it to the grower.

As transportation by water is both cheaper and better for fruit, a great advantage is possessed by those on the lake shore, with easy access to the great markets of Chicago, and through them to the whole northwest.

The next most important question to be answered is, "What varieties shall I plant?" This can be answered by examining carefully the market demand and the year-book of some successful peach grower. Attention must be given to the natural succession of varieties in time of ripening, so as to have fruit in the market continuously during the whole season. Almost always there is some demand for peaches earlier in the summer than they can ripen in Michigan, and this causes them to be shipped to our markets from the warmer regions of the southeast, but as soon as our northern fruit can be ripened its superior flavor and freshness compels recognition and cash in the market. But at best the call for very early fruit is spasmodic, and can not be depended upon for large quantities, as can the more healthy demand for the superior quality of fruit which ripens during the middle and last of the season. These considerations will lead us to plant our trees so as to have a few early peaches, more following directly on, and keeping a full stock up to the end of the season.

The time of ripening will of course vary somewhat with the season and from local causes, but generally lasts about three months. Some of the earliest, such as Gov. Garland, Amsden, Brigg's May, or Waterloo, mature by or before the first of August, while the Smock, Salway, Gudgeon's Late, and many others require till near November first, and often later, before they are fit for shipment. Between these extremes many good varieties will ripen. It will not pay, however, to have too many varieties. Here, as elsewhere, experience is a dear teacher, and it is wiser to profit by the experience of others. Neither is it safe to trust too much to the descriptions given in nursery lists nor the highly-colored pen pictures of "disinterested" journalists. Better far to visit the large market or trial orchards and carefully note the condition and record of each variety. It is necessary that a profitable market orchard should have several varieties, but it were better to have only *two* than two hundred, or even *too many.*

A careful examination must be made also in regard to the hardiness of different kinds, and many will have to be condemned for our use, because their tenderness renders them unprofitable in comparison with some variety less excellent in quality but superior in fruitfulness.

This is notably true in the case of the Early Crawford, an old, and if only reliable, a most valuable variety. But as it can be depended upon for a good crop only once in four years or more, it yields the palm of profit to the Hale's Early, of much inferior quality, to the Barnard and Snow's Orange, and to many others which are hardier, and therefore more profitable.

The fiery, or rather *frosty* trial of the winter of 1884–85, clearly demonstrated that a few varieties only will survive such extremes, and that in them consequently lies the greatest profit. A strictly market orchard, planted with but one purpose, the *greatest gain* in *the shortest time*, would probably best contain not more than *six* varieties. All things considered from the experience of the last winter, and several years' study of the markets, I will name, as best suited to the purpose of profit, the following six, in order of time of ripening, viz., Hale's Early, Yellow Alberg, Jacques Rareripe, Hill's Chili, Golden Drop and Smock. If planting an orchard of one thousand (1,000) trees I should cut the number to four varieties, and set two hundred Hales, two hundred Jacques, three hundred Hill's Chili, and three hundred Golden Drop.

It is noteworthy also that Hale's and most of the early varieties prefer a sandy soil, and that Hill's Chili, Golden Drop, and some others do as well or better on clay.

The question of how many trees to plant, and what distance apart, also demands our attention. One's ability and plans must govern entirely in deciding the first. A small orchard well cared for is a better investment than a large but neglected one. One thousand (1,000) trees is all one man and team could do justice to, and even then he would need extra help during much of the summer season. As to space in planting—nothing is gained by trying to get a few more trees to the acre.

They need plenty of room, and if set nearer than eighteen to twenty feet they will crowd each other by the time they are six years old, and so shade the ground as to make it dark, cold, and damp, all of which is fatal to the best results. Twenty by twenty feet will set about 125 trees to the acre, and is better than any less distance.

As the first two years of a child's life are of the greatest importance in its welfare, so the early growth of a peach tree will be quite a correct index to its whole career. It needs all the benefit of frequent cultivation, and for two years this can be best done by planting the orchard to corn between rows and giving it usual tillage. It is a good plan to plant the four hills nearest the tree the second year to potatoes instead of corn, so as to give the growing tree all that it needs of space and light. The third year the tree ought to have the whole ground, and just as frequent and careful cultivation as before. The trimming should be particularly and timely done, so as to give proper form to the top without wasting a year or two in growing a great mass which must be eventually cut out. Such treatment faithfully practiced will be appreciated and by the fourth season will begin to repay one for his time and labor.

I know one orchard of three hundred trees which, when three years old, marketed twelve hundred baskets of peaches, an average of four baskets or one bushel per tree, and that fall peaches netted $3 per bushel. This gave a net cash income of $360 per acre from three-year-old trees, a record rarely equalled at that age, though often surpassed by older orchards. Indeed, *half* of the same orchard, now seven years old, yielded a larger income this last fall (1885), even after the severities of the preceding winter.

It is necessary to exercise care in beginning cultivation in the spring, so as not to stimulate a too early start, and thus render the trees liable to be injured by the spring frosts. It is also dangerous to continue the cultivation late in the summer, and so induce a vigorous and long continued growth in the fall, as the trees are much less liable to winter killing if the cultivation is stopped in time for the wood to become thoroughly ripe and hard. During the months of June and July the growth of the peach tree should be encouraged by frequent and thorough cultivation, averaging at least, once a week. About the first week in August the ground should be put in shape to remain through the winter. It is a custom much practiced by some to sow rye or oats, or both mixed, or clover seed in the orchard at the time of this last cultivation. This crop growing up will form quite an effective trap to hold the leaves and snow, thus forming a valuable mulch, while the rye or clover provides a good crop to plow under in May.

The limits of this paper forbid more than a reference to a few other prominent points in connection with peach culture. The first is in regard to curculio and rose bugs. These pests have been very injurious in many places and at different times. The many remedies advocated are alike valueless, except as they are persistently applied, so that here again it *pays* to be thorough. "Early to bed and early to rise" is an essential if one would eat peaches later in the season.

The next item is that of thinning. Frequently a tree will set three or four times as many peaches as it is profitable for it to mature. In such a case they should be carefully thinned by hand just as soon as the season of curculio is over, generally about July first. It is best not to have them thick enough on the twigs so that when grown to full size they will touch each other. This will insure room to mature, and will also hinder the spread of the rot. True it is that much work can be saved in this operation, by allowing the bugs to do the thinning, but if left to them it will be painfully evident in the fall that the thinning has extended to the *pocket* as well as to the trees.

A word further concerning shipping. The more care there is used in marketing the crop the greater will be the profit. Now, more than at any previous time, particular, skillful work is needed, *for it pays.*

Careful, intelligent workmanship in picking, packing and in *all* the *handling will prevent losses, insure the highest prices* and thus *save the profits.* Strict honesty will also prove the best policy, even when there is great chance for and temptation to cheat. As a rule, a good average standard package of fruit will bring a good price and create a demand for more of the same kind.

Not so much as many think is due to *chance* in peach culture. *Thoroughness tells*, here no less then in general farming, and the maxim, "What is worth doing at all is worth doing well," is the only key to success. Good, common sense, hard work, care, perseverance, honesty,—these are characteristics needed by the fruit grower, which persisted in will win the victory—*and the peaches.*

President Willits: I would like to know if peaches were killed here last winter. The papers say with 28° they were not.

Voice: Trees were not killed, though the fruit was.

Prof. Bailey: Prof. Merritt speaks from experience. I can only speak of the prospects of peach culture in central Michigan.

It has long been successful in the "fruit belt," but I believe it may be made so in central Michigan. But for this certain conditions and experiments are needed. The peach becomes rapidly acclimated, e. g., Early Crawford in Mississippi is killed by 0, and here will stand -15°.

The Hill's Chili is the hardiest variety I know of, and it reproduces itself by seed, giving us two strong points to start with.

In Russia they experimented with plums by growing them on hillsides at an angle of 45° and staking them down in winter.

I am going to try the possibilities of breeding a hardier variety at the college from pits of the Hill's Chili.

The worst feature is, not winter cold, but late spring cold. We see trees north of buildings bear, while trees out of the shade are killed, because those north of the building are kept back till the danger from spring frosts is past. So on the lake shore, they have no late spring frosts.

A. T. Lindeman says he can protect his peach trees at 30 cents apiece. I think there is a future for peach growing in central Michigan, at least on those well drained knolls where the trees will not have wet feet.

FOUR IMPORTANT INSECTICIDES.

BY PROF. A. J. COOK.

[Read at the St. Louis and Quincy Institutes.]

There is no question but that our insect enemies are rapidly increasing in numbers and destructiveness. Many in this audience can well remember when plums were as sure a crop as are pig weeds to-day; when apples were as beautiful and fair as the cheeks of the country lass; when corn and wheat leaped forth from the ground with no cut-worm to bite asunder, and no Hessian fly to blight. Who of you in the olden time ever saw oats sown by the innumerable locusts, while yet green, as they were all over our State the past summer. Of course we would all like our work done for us, but we would like these grasshoppers to study up the subject and learn the proper season for sowing before they again scatter our fields with the grain.

There are two prominent reasons why insects are so increasing in numbers and in their ravages. First, as is true with the cut-worms, the locusts, and the curculio, we are destroying their native food plants, and they are rapidly learning year by year that our cultivated plants are just as wholesome, and even more toothsome, than their old aliment which we have ruthlessly destroyed. Again, we are constantly introducing new insect pests from over the sea, which prove to be more destructive than in their old homes and more than rivals for our native insects with like habits. The codling moth, currant slug, and clover root borer are apt illustrations of these unwelcome foreigners. Whatever we may think about the Chinee, I am sure no one would chide a word, should Congress lay a permanent embargo on the further immigration to our shores of these pernicious insects.

Yet this picture has its lights as well as its shades. While new and most formidable insects are pouring in upon us, we are constantly learning of new ways and methods to head them off. We often read in our agricultural papers that the fence question is one of the most important ones that now concerns our farming population. What better then than that I should explain in the brief space allotted to me how that you can *fence out* some of these most troublesome insects.

Paris green and London purple are well know to all of you. Yet few, even of our best read farmers, are fully informed as to the precise extent and limit of their usefulness. The advantages of these arsenites is that they are quick death to everything that eats them. Insects are very small, so small that often a tiny speck is a stomach full to them. Hence the smallest speck of these arsenical poisons, if eaten by any insect, is absolutely sure to send it over Jordan, much to the delight of any farmer whose acres are on this side of that memorable river. Please bear in mind this fact, that *the faintest trace of these arsenites will surely kill any insect that eats it.*

The objections to these arsenites as insecticides are first, that they must be eaten to produce their effect, and secondly that if eaten by higher animals—even by man himself—they deal out the same death potion. Used then on plant or bark lice or upon any of the bugs, they prove an entire failure. Such insects insert their sharp beaks through the outside skin or bark and suck the inner blood or sap. Hence they would reach through any superficial coating of Paris green, and would be entirely unharmed by such application. In like manner the curculio laughs in its sleeve at our attempt to check its ravages by use of *these* substances. The female weevil *knows* enough to push her nose or snout right through the poison, and cut out that elegant crescent, after which she crowds the egg through the skin of the fruit safe beyond the deadly bait which may rest outside the plum. Thus when any one tells you that you can stay the ravages of the plum curculio with Paris green, just say, *sotto voce*, if you think it more prudent—that is a li-kely story.

A graver objection to the arsenites is the danger that from carelessness they may be eaten by stock or by people and so produce serious loss or even worse, bring heaviest sorrow. I have even heard one person urge that in this world of sorrow and uncertainties and consequent heavy hearts, no such ready weapon should be in arm's reach of the would-be suicide.

It should be said in this connection that nearly, if not every accident from the arsenites, has arisen from culpable carelessness. Paris green mixed with flour is left exposed where cattle gain access to it. Or worse still is laid on shelf or in cupboard, and is taken for quinine or Dover's powders. For this reason I vehemently protest against the use of common white arsenic—arsenious acid—in place of Paris green and London purple, which is being so stoutly urged by one of our western horticultural professors. I know white arsenic is cheaper, but how easy to mistake it for medicine or some culinary article, and how multiplied the danger in its use over that of the more peculiar Paris green and London purple, whose very color would be the skull and cross-bones that would warn of danger and save life.

Another dangerous practice is that of handling these poisons with the bare hands, especially in case there is a break in the skin. This is apt to give the poison ingress to the blood, and may do serious harm—even produce death. I would never handle such virulent poisons with the unprotected hands. Nor would I run any risk of breathing the dust. I believe that all that is necessary to make the use of these substances entirely safe, is just reasonable caution. I fully believe that general as is their use, more deaths by far occur from careless handling of fire-arms than from the use of these arsenites.

I have already indicated that these substances are wholly valueless in fighting plant lice and other haustellate insects which include all the bugs. But in all cases where the habits of the insects will insure their eating the poison, and when we run no risk in the use of the poison, then no other insecticide so far as I have examined is so efficient as these arsenites.

Let me indicate where you can all use these poisons at an enormous advantage. That is in your apple orchards just after the blossoms fall, the last of May. This use, as I have repeatedly shown, is almost a perfect remedy against the codling moth, and at the same time will put to rout the canker worm should it be present in the orchard, will prove certain death to the species of leaf rollers which are becoming so destructive in our State, but which are often hardly noticed ; and will also prove the death knell to the familiar old tent caterpillar should it choose to pitch its tents in peparation for a siege. In this work I would use a pound of the poison—both the London purple and the Paris green are equally efficient if pure—to fifty gallons of water. As the minerals are only held in suspension and not in solution, it is necessary to frequently stir the mixture to prevent the minerals settling to the bottom of the vessel. To use it we have only to put the barrels containing it in a wagon, drive along between the rows of trees, and by aid of a force pump and hose with a spraying nozzle, we can quickly, easily, and cheaply make the application. In case we have only a few trees Whitman's fountain pump is excellent, and this pump is very desirable for many purposes about a house, especially in case of fire. The cyclone nozzle is perhaps the best, and certainly leaves nothing to be desired in way of economy. In western New York they attach the pump handle to the wagon wheel in such a way that the pumping goes on without hand labor. Close fitting floats in the barrel prevent wasting of the liquid mixture, while a hole through this float receives the pipe from the pump. Another hole allows the handle of a stirrer to pass from the barrel. A trial of this remedy now for six successive years makes me very confident that it is not only the best remedy for this worst pest of the apple grower, but is almost all that could be desired. I have almost banished this pest from my fruit. As this remedy will save its cost in the destruction of the other insects named, we may at most say that the codling moth is exterminated without expense.

But what of the danger of such use ? True, some of the poison will fall on the grass beneath the trees, but it will be very little and will soon be blown and washed off, so that we have only to keep the stock from the orchard for a few days, and there will be no possible danger in this direction.

Again, how about the fruit? It will be remembered that we applied the poison the last of May. We use none of the fruit till late in August, and long before this the wind has carried off the very last vestige, as I have proved by repeated examinations with the microscope and the chemist's analyses. But how is it that a May application of the poison kills the July brood of larvæ if the last trace of the poison is blown away soon after its use ? I can only say that it does, and probably because if the first brood is destroyed the seed for the second brood is absent. In case trees near by are not treated then, of course in case a second application was not made about July 4th, we could not expect such satisfactory results. I must say that I have been surprised and at a loss to explain the wonderful virtue of a single treatment as given above.

The arsenites are also just the thing to fight leaf rollers, slugs, etc., that attack the foliage and threaten with destruction our shade and ornamental trees. But I would never think to use them to repel the currant slug, which is feeding on the foliage just as we are picking and eating the green fruit, nor upon cabbages, especially to protect against the second brood of caterpillars. Here the very conformation of the cabbage makes it easy for the rain to wash the poison down where it may lodge at the base of the leaves and await opportunity to do its fatal work.

By use of the fountain pump and a long rubber tube attached to an equally long, light stick, which shall connect the pump with the cyclone nozzle, we can spray trees that are many feet in height, and this with great economy of the poison.

BUHACH, OR CALIFORNIA PYRETHRUM.

I next call your attention to Buhach, or California Pyrethrum. This valuable insecticide consists of the powdered flowers, stems and leaves of a plant closely related to our common chrysanthemum. The plant used in California is *P. cineraræ folium*, though that from *P. roseum*, and *P. carneum* is also effective. The dry powder, an alcoholic extract, a simple water solution, or a decoction even of the unground plants as well as of the powder, can all be used. The solution in cold water I have found efficient, and it is certainly most convenient to use of any form except in the powdered state. And I have found it more effective in field operations than is the powder, probably because it is more scattered as it is sent on in a spray with a force pump, and so strikes more of the insects. This substance kills by contact, not by being eaten. Another peculiarity of this powder is that the essential principle is volatile, and so unless the Buhach is kept in a close, tight box or jar, it soon becomes worthless. It is best to keep it in tin boxes or in fruit jars. We see then that old powder is very likely to become valueless, especially if left in drawers or open boxes, as is often the case in drug stores.

The advantages of this insecticide are these: It is entirely non-poisonous to the higher animals. Thus there is no possible danger of its use, even in the hands of the careless. Again, it kills by contact and not by being eaten, and so may be used with success in destroying insects where the nature of the case precludes the possibility of the getting the insects to eat it. Thus we use it to kill house flies, poultry lice and other vermin that attack and injure our domestic animals, and also with success to destroy the plant lice which are often so vexatious on house plants.

The objections to this insecticide are, first: its decline in value from age. Thus it is that so many try it and pronounce it worthless. They used a worthless article. Again, it is powerless to effect any injury on many of our worst insect pests.

Thus I have found it wholly useless to defend against our destructive bugs and most beetles. Mr. E. S. Carman says it destroys the rose chafer, which if true is not only exceptional, but very important, as that is one of our most destructive insects. Again, this substance must actually come in contact with the insect, while the arsenites have but to strike the leaves that are to be eaten. As this soon loses its virtue, unless it actually strikes the insect, it seldom proves effective, hence insects beneath leaves are liable to escape unharmed. This is why the watery spray is more apt to succeed than is the dry powder. I find we can distribute the spray with a force pump more thoroughly than we can the powder, even with the excellent dust-bellows which are now in the market.

The justly dreaded cabbage caterpillar, that green larva that early riddles the leaves, and later tunnels the cabbages through and through until the carving knife slices it with the savory vegetable, to the horror of the cook, is easily and safely put *hors de combat* by use of this excellent Buhach. I find that it serves best when applied as a watery spray by use of the Woodason Spray Bellows. This dashes the spray onto the plant, so that nearly every larva is sure to receive the death sentence, and I find it a very economical instrument, as a single pint of liquid will suffice for a large number of plants. One caution should be observed: "'Tis the early bird that catches the worm," so we can not be too early in treating these harmful caterpillars. By charging the foe as soon as they charge upon the cabbage, we destroy the first brood before the cabbages are much injured, and no gardener need be told how important it is to keep these younglings vigorous. Infancy is the susceptible period both with animals and plants. Prompt warfare is even more imperative with the second brood, for now the plants are headed, and unless the larvæ are charged upon before they throw up those impregnable breastworks, by tunneling far into the cabbages, our efforts for their destruction will be largely in vain. Here, then, we have as cheap and as efficient a weapon to defend against these invaders from the old world as we have in Paris green, and the Buhach is entirely safe. How, then, can any one defend the use of the arsenites in such warfare?

Pyrethrum is also a sure destroyer of house flies, plant lice, vermin on poultry and other domestic animals, and nearly all plant-eating larvæ. On poultry, cattle and horses it is used as a powder and dusted into the hair and feathers. By following the hand, as it strokes the animal against the hair and feathers, by a good dust-bellows the dust is quickly applied. On cattle and horses this has to be used so many times to do efficient work that I have preferred the use of a decoction of tobacco, which will usually do wondrous execution even with one thorough application. And I have no hesitation in saying that it is more rational to use this poison—tobacco—in killing lice than to use it killing our boys, while I know that the former use is much less nauseating, as it is very quickly over.

The only trouble with this insecticide is the difficulty of procuring a good article. Professor W. W. Tracy informs me that though he has bought it at various times and at several different places in Detroit, he has rarely failed to get a good article; yet from a wide correspondence with parties in many parts of the country I think that his experience is not that of many others. If I were to buy of a druggist in any of our towns I should buy sparingly, till I had tested it. By blowing with the aid of a cheap hand bellows a half teaspoonful into a room containing house flies it is easy to determine its value. If in a few moments all the flies fall helpless to the floor, we know the article is good, and we can safely buy more. If we find that the flies pay no attention to the dust, but are as gay and festive as ever, then we better buy no more. The common Pyrethrum or Persian insect powder comes from abroad, and is often old and worthless, perhaps from age, often from adulteration. The safest way is to send, or have our druggist, direct to G. N. Milco, Stockton, California We are then sure, I believe, to secure a fresh and pure article. Mr. Milco is an extensive grower and manufacturer of the article, and could not afford to send out a spurious or inferior article even if he was dishonest enough to do so. I have now secured direct from Mr. Milco for three successive years enough of this powder for my use and experiments, and I have found it always reliable and of the best quality.

Before leaving this subject let me say that I learned a new and very gratifying use for this Buhach last summer. I found that by washing our horses in several places every hour or two they were relieved from the pestiferous presence of flies. It is easy to keep a bottle with a solution in the field, and as often as necessary use a little about the horses, when our team works with much less irritation, both on the part of the horses and the driver.

THE KEROSENE EMULSION.

To make this I take a quart of soft soap mixed with a gallon of water, and then heat it to a boiling temperature, when I add a pint of kerosene oil. It is not necessary to use so much soap, but as the soap as well as the oil is an insecticide, and as the mixture of the oil with the soap solution is more thorough and permanent, in case of an abundance of soap, I am led to advise the amount named above. When adding the oil I thoroughly stir the mixture. This is easily done by pumping by aid of the fountain pump the liquid mixture back into the vessel. If there is a failure to mix or to remain thoroughly commingled, for any reason, it is always easy to re-mix as just described, immediately before we are to use the liquid.

I have found this kerosene and soap emulsion harmless to all plants on which I have used it, and very destructive to most insects with which it comes thoroughly in contact. All of you know how destructive plant lice often are to our fruit and ornamental trees. One application of this emulsion will thoroughly exterminate these terrible sappers.

Mr. Hanford, of Bristol, Indiana, who supplies so many of us Michigan people with fruit, wrote to me a year or two ago that his fruit trees were suffering terribly from the attacks of plant lice and asked for a cure. I explained what I have described above. He told me at the meeting of the United States Horticultural Society last September, that he used the remedy and saved the trees. About a year ago I was appealed to by Mr. Aldrich, of the Coldwater *Republican*, and many others for a remedy for the maple bark or scale louse. Nearly all our fruit and valuable shade and ornamental trees are frequent victims to one or more species of these bark lice. Our experiments at the college prove conclusively that if applied just as the eggs of the lice hatch, these pernicious lice can be most beautifully cleaned out by a thorough spraying with this same kerosene and soap emulsion. In most all cases these bark lice eggs hatch in June.

Again, for the past few years our cabbages have suffered terribly from the attack of the cabbage maggot, which by tunneling and furrowing the underground stem ruins the young plants just after the cabbages are set out. The eggs are laid and the injury commenced even while the plants are yet in the hot beds. Now if applied early this kerosene emulsion is sure death to these maggots. It will not do to wait till the maggots have worked a tunnel far into the roots, and thus fashioned a place of retreat safe from all possible disturbance, and also blighted the plants beyond any possible hope of recovery. The liquid mixture must be applied early, when the flies first come around, and every two or three days until the flies are gone, and then a sure riddance may be counted on. The closely related radish and onion maggots, both of which are serious pests in our State, can be destroyed in the same way. This insecticide is much to be preferred to bisulphide of carbon for this purpose, as it is just as effective and is in no danger of injuring the plants. This emulsion is also a most excellent wash for the trunks and main branches of our apple trees. It will not only kill the apple tree bark louse as already stated, but will also prevent the beetles which are parents of the destructive borers from laying their eggs. This washing should be done about the 10th of June. Such washing early in June is sure to pay a great interest.

The fourth, and the last insecticide that I shall discuss in this paper, is gas lime. This is refuse material which arises in the manufactory of illuminating gas, and so where we are near gas works will cost us nothing. It appears to be very poisonous to insects; yet so far as I have tried it does not appear to be in the least inimical to plant growth.

This has long been recommended in England and other parts of Europe as a most valuable insecticide. A few years ago, I procured some and tried it, with almost no benefit. Last summer I secured some more, quite fresh, and found it exceedingly effective. I now think that the material I secured when I first tried it was old and worthless. I have mixed it with water and used it dry as a powder, and in both cases found it very satisfactory indeed.

The fact that the gas lime procured at one time was worthless, and at another valuable, raises the question of course as to the reliability of this insecticide. And the further question of whether we know, because the sample last used was not injurious to the plants, another sample secured at another time and place, might not be very hurtful to them. These are questions which I intend to solve in the future. I will now add that the material used this summer was entirely fresh. I was so well pleased with its use both on leaf-eating insects like the cabbage caterpillar and flea beetles, as well as on the cabbage and radish maggots, that I thought it well to suggest its use to others that they might also experiment with it, and if is as good a remedy as I hope and have reason to believe, may at once have the benefit accruing from its use. There is one signal advantage in this insecticide, it only costs the trouble of getting it, though should it prove valuable this might not remain true very long.

To use this substance on leaf-eating insects, we may scatter it on as a powder, or mix it with water and sprinkle the plants with it. I have reason to believe that if a little of it is incorporated in the soil in beds where radishes and cabbages are being grown that the destructive maggots will not put in an appearance. We tried it on plants already attacked and found that all the maggots actually touched by the powder were speedily killed. Like the kerosene emulsion, to give perfect satisfaction, it must be applied as early at least as the flies come to deposit the eggs. It is very possible that by scattering this gas lime on our squash vines in June, we might stay the ravages of that dreaded pest, the squash borer.

There are other remedies that I might discuss. I might also occupy time advantageously in describing some of our new insect enemies, and some of the numerous parasites and predacious insects that are so powerfully aiding us in this insect warfare; but recognizing as I do the great value of the discussions which follow these papers, I give way, that there may be no stint in the time given to the further consideration of this theme, in which you all shall be participants.

Mr. Shaw: I have tried for three years to find why we had no fruit on my apple trees. The bark louse has in four years killed four trees for me. They are on nursery trees brought from New York. I killed the lice with kerosene emulsion applied with a force pump. Mr. Darrow did the same to his trees last year and his trees made a good growth. I use a double-barreled force pump, cost $13. On first application you see no effect, but after a few days their scales shell off from the bark. I use four quarts kerosene, two quarts sour milk, one quart water, mix cold and add sixteen quarts water.

Prof. Cook: I have tried this milk emulsion and found that it injures the foliage.

Mr. S. Moody: I have tried weak lye, soap, etc., on my trees and have very few lice.

Prof. Cook: Soft soap will kill them, but adding the kerosene makes it a surer thing.

Mr. Howard: How strong a solution of soft soap and water can you use safely?

Mr. Moody: Half soap and half water.

Prof. Cook: You can safely use clear soap.

Mr. Shaw read from p. 331 U. S. Report Department of Agriculture for 1884, as follows:

It can not be too strongly impressed upon all who use kerosene as an insecticide that it can be considered a safe remedy only when properly emulsified.

The formula for the kerosene and soap emulsion as found most satisfactory by Mr. Hubbard is as follows:

Kerosene	2 gallons	—67 per cent.
Common soap or whale oil soap	½ pound	—33 per cent.
Water	1 gallon	

Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force pump and spray nozzle for five or ten minutes. The emulsion, if perfect, forms a cream which thickens on cooling and should adhere without oiliness to the surface of the glass.

Dilute, before using, one part of the emulsion with nine parts of cold water. The above formula gives three gallons of emulsion and makes when diluted thirty gallons of wash.

The kerosene and soap mixture, especially when the latter is warmed, forms upon very moderate agitation, an apparent union; but the mixture is not stable, and separates on standing or when cooled or diluted by the addition of water.

A proper emulsion of kerosene is obtained only upon violent agitation. It is formed not gradually, but suddenly; in short, to use a familiar phrase, "it comes" like butter. The time required in churning depends somewhat upon the violence of the agitation, but still more upon the temperature, which however need not be much above blood heat.

Prof. Cook: We have never found that a proportion of one part kerosene to five parts of water would hurt foliage at all if a perfect emulsion was made.

Mr. Morse: I would like to ask what will kill the cut worms that attack our corn fields?

Prof. Cook: I wish we knew better than we do. The wire worm and cut worm are tough customers. London purple or Paris green would kill them if we can persuade them to eat it. I would recommend the trial of this plan just as the corn is sprouting. Cultivate the ground very clean, and then spread here and there bunches of freshly cut grass sprinkled with the poison. I believe that it would do the work. I know that on a clean garden soil such wads of grass cause the cut worms to gather in large numbers under them.

Mr ———: Would it not be well to invert the bunches of grass after sprinkling the poison on them, so as to bring it where the worms are?

Prof. Cook: Probably. The eggs from which cut worms are hatched are always laid in sod, and cut worms are always worse in corn that is planted where a sod has been plowed under. Perhaps fall plowing would be useful—not to freeze the worms, for that won't hurt them. I have frozen them as hard as an icicle, and when they warm up they are as lively as ever. But fall plowing and spring harrowing exposes them to the birds. Why not plant corn by drill, using a good deal of seed—two or three for the blackbirds, three or four for the crows, five or six for the cut worms, and three or four to grow. Then go around, and where you find the corn cut off the creature is there, just under the surface, *dig him out.*

Mr. ———: Why not try gas lime?

Prof. Cook: A good idea. Try it, sprinkling on the hills.

Mr. Lewis: Would salt and ashes do any good?

Prof. Cook: Not for cut worms.

Mr. ———: What will kill pear slugs?

Prof. Cook: Kerosene emulsion is perfectly sure.

Mr. ———: How about currant worm?

Prof. Cook: Powdered white hellebore is a sure thing.

Mr. ———: How about curculio?

Prof. Cook: Judge Ramsdell says the curculio is a benefit to plum men, as when plums are plenty they thin them out, and other times they help the price. Soak rags with carbolic acid and tie around the tree and it will kill the tree and not hurt the curculio. Paris green, kerosene emulsion, and other poisons are of no avail against the curculio. He will not eat them. They begin to work when the crown falls from the plum. Then early in morning or late in the afternoon, put a sheet under the tree and jar the tree, the insects will fall and you can gather and kill them. Use a padded mallet and the weevils will fall on sheet. They look *exactly* like buds. Keep this going till July 4.

Mr. ———: Do you do this every night?

Prof. Cook: No, try every little while, and as often as you get curculio keep on every night.

Prof. Beal: For 50 trees it costs about 6 cents per tree.

Query: What fruits do they affect?

Prof. Cook: Plum, cherry, apple, peach. The papers say put cotton batting around tree. It will do no good; they fly excellently.

Mr. ———: A new worm is working in my apples this year that does not go to the core but burrows all around through the substance.

Prof. Cook: That is the apple maggot. They can only be killed by feeding to hogs or cattle.

Mr. ———: Can you circumvent the coddling moth?

Mr. Cook: Certainly. By spraying the trees late in May with a well-stirred mixture of one pound of Paris green and fifty gallons of water; and by this same process you will also kill off the leaf-rollers, canker worms and tent caterpillars.

Mr. ———: What does kerosene emulsion do for the peach borer?

Prof. Cook: A great deal of good, i. e., for the tree. It might be entirely effectual A man told me it was no good. I found that he applied it in September and March. He should have done it July 4 and July 25. But for the peach borer there is nothing so good as digging out and pinching.

Mr. ———: What is best for the Colorado beetle?

Prof. Cook: Paris green or London purple. For early crop mix in flour one-tenth and use on melons and cucumbers, sprinkle on as little as you can. This for when plants first appear. When large use 1 to 50.

Prof. Bailey: I wish to emphasize the fact that the only way to treat the peach borer is to dig him out. I have known acres of trees ruined. In our neighborhood the fruit growers united in a crusade against this beetle and cleaned him out of the region so that now they are rarely found there.

INDUSTRIAL GEOLOGY.

BY PROF. A. J. COOK.

We have learned in these Farmers' Institutes, which now have been in operation for twelve years, that he who is privileged to speak is sure to address men who think, read, and study; intelligent men, who keenly appreciate anything in science or practice, especially if it has a practical ring to it, or in any way touches the everyday affairs of life. Thus I need offer no apology for my theme to-night. Geology, which has for its purpose the giving of a full history of our earth, from the dawn of its creation all down the ages, even to our own day, is one of the grandest of sciences. Indeed, it includes all the natural sciences. In the early days of the earth's formation it was one grand chemical laboratory, where test tube, beaker, and crucible were large as the world itself, and where precipitation, solution, filtration, and sublimation were great as the substance on which they had to work. And what a mineralogist has Geology been, for in her cabinets were all rocks, and in her work rooms was the gold and silver massed in vast rock beds, and the emerald and diamond fashioned from baser rock to fairest gem. She laid her hands on the decaying brush wood of fens and marshes, and transformed them into our vast mines of coal. She set up her mighty stills, and stored in rocky vaults the oil and gas to await the era when mind could unlock the vaults and use the precious contents to light the world. Nor was Geology less a Botanist. She saw the first sea weeds, then the flowerless land plants, and finally rejoiced in the beautiful and varied flora of the present age. Nor was her eye less keen for the higher animal life. She saw the simple sea animals, then the more complex, and ages after the huge land animals, and finally the grand harmony of animal life which we all so much admire to day, and of which we form a part.

Geology, as a science, is hardly older than some who are present here to-night. And though one of the youngest of the sciences, what a revolutionist she has been. She found the world believing in a seven literal days' work of creation. She has proved, so that now no intelligent student of the subjects doubts her dictum, that the world was ages in its development, and that each of Moses' days was a vast period. Instead of 24 hours, it was millions of centuries. She has proved that our world home, instead of flashing forth finished and complete at the Divine fiat, has been slowly evolved from the simple to the complex under the controlling impulse of just such laws as we see working about us today. Thus in demonstrating the evolution, under God's laws, of our world home, she has prepared us for the reception of the still more startling truth: the evolution of the myriad inhabitants of that same home.

Geology also shows that man reaches back not a few thousand, but many thousands—perhaps a million or more—of years. All these startling truths, brought out by this science, and so thoroughly proved that even laymen have accepted their verity, are enough in themselves to make the science and its teachings a matter of general interest to all who enjoy study and research, and are eager to know and understand the truth.

Again, as geology shows us just how our earth has been fashioned, how its great fields have been plowed and harrowed, just what fertilizers nature has made use of, under just what conditions the land has been tilled, it becomes evident at once that this is a practical science. Not only may we look for direction as to where the mines and the quarries may be found, but we may also learn where to look for rich soils, and may gain data whereby to judge the agricultural probabilities of each State and section of our country. Let us examine the methods of nature as exhibited by this science, and interrogate the science itself as to the resources, present and prospective, of our beloved Michigan.

The crystallization of the older rocks, the changing of wood into stone coal, the formation from coarse rock material of such gems as rubies, emeralds and diamonds, the baked and altered condition of many rocks, has convinced all students that our earth was once a molten mass, red-hot, aye white-hot, like our present sun, and yet this ball of fire went swinging through space then as to-day. The form of the earth—an oblate spheroid bulging at the equator and flattened at the poles—is just what it must have become as a melted sphere, rolling on its axis so rapidly that each point on the equator moved 25,000 miles each 24 hours. Every farm boy knows of centrifugal force, though he may never have heard the word in his life. Has he not watched the water as it flew from the grind-stone, flying further as he turned faster? If he turns slowly, the water, by its adhesion, adheres to the stone, and does not fly off at all. Could the lad turn fast enough the centrifugal force would finally burst the stone, as is not infrequently the case with large wheels connected with steam engines. We know now how this centrifugal force is made our servant, as when the bee-keeper uses it to throw the beautiful liquid honey clean from the comb. Now, in those early first days, the rapid revolutions of the earth tended to throw its parts off, and most at the equator. Gravitation pulled in the opposite direction, and while she could not prevent all her large family of liquid particles from crowding out, she could attract sufficiently to prevent any from entirely leaving the old home. You see that then, as to-day, it took attraction to keep all the family at home.

Exact mathematical calculation proves that the form of the earth is just what it would be if liquid, and controlled by these two forces: the centrifugal force consequent upon its daily revolution and the force inherent in matter which we call gravity. This, then, is another proof that our world was once a molten mass. The increasing heat as we go towards the centre of the earth, and the fact of earthquakes and volcanoes are often given as added proofs that the early condition of our sphere was a molten one. Of course you already know that we find imbedded in the rocks the remains of the old-time life—ancient plants and animals. These fossils, as we call them, show that the earth's surface in the early ages was equally warm at pole and equator. No chance then, you see, for martyrs to north pole expeditions. In those old rock fossils, even of Greenland, we find remains of palms and tropical animal life like corals; thus we know that in the childhood and youth of our planet, tropic heat bathed the poles as it to-day warms the equator.

Now, how can we account for this extra heat in the earlier years of our earth sphere? It is not likely that the sun regarded us any more warmly then than now. If the earth cooled from a melted condition, heat would be constantly given out, and for ages the heat from the interior furnace would be far more than that sent down from the solar chandelier, and hence the more than tropical heat that bathed the young world from pole to pole. The strength and vigor of our earth would seem to disapprove the modern notion that a hot-house is not a good place in which to bring up children.

Many geologists think that the world is still molten at the center. Others think that the center is solid. All think it is hot, but the latter class just referred to think that the added pressure and consequent density and solidity at the earth's center have raised the melting point, so that, though while there may be and doubtless are lakes of molten matter near the surface, the center is at last solid.

Of course as time went on the earth's heat would radiate into space, as does that from the sun to-day. A crust would form as a result of this cooling down, which crust would become thicker and thicker. At last the heat would be so tempered—as the ever thickening crust would hold back the imprisoned heat—that the waters until now driven as dense fogs and clouds far off, enshrouding the earth with the mists of darkness, would settle down upon the earth and for the first time we would have land and water.

There is good reason to believe that at first the water covered much more of the earth's crust than it does to-day. There were then no mountains, and very probably only shallow oceans. The present continent of North America was marked out in a small V-shaped mass of land, which with its vertex in Northern New York extended northeast through Canada and northwest through our own northern peninsula.

With the exception of this small nucleus continent all of the United States and of North America was one boundless sea, if we may except a few islands—one or two in the Missouri region, a few strung along the Rocky mountain trend, and a long narrow one, possibly a peninsula, stretching from New England south, as the Alleghany mountains mark that region to-day. Thus we see that our own northern peninsula was there when the young world was lisping its first prattle and doing its little part in that grand old anthem—the music of the spheres. Europe had no continental beginning, as she started as an archipelago. While our land started as a continent and builded thereon, Europe had only isolated islands and used these as so many nuclei, from which she fashioned her little self into a continent.

Some of you may wonder how we know all this. The handwriting on the wall of the everlasting rocks is so plain that there can be no mistake in the reading.

All the rocks of the world, except those just referred to, show clearly by their structure and appearance that they were formed by the wearing and transporting action of water. Every reading person knows with what tremendous force the ocean waves dash against the rock-bound shores. Well is it that the engineer knows it, else such structures as the Eddystone light-house, built of the best material that the engineer can find or make, and monuments of the very highest type of engineering skill would crumble much sooner than they do. No rock or substance is so hard that it can resist this mighty tearing force of the ocean waves. And thus all down the ages this ceaseless, resistless, awful power has been grinding and piling up the rock, and thus have been builded up the continents and islands which now adorn our world home. All the upper rocks of our vast territory, with the exception of that already referred to—and quite possibly that is no exception—and the insignificant rock areas of lava, which are of volcanic origin, have all been ground up, carried often for a long distance, and thrown down to be trodden upon by the heavy foot of time till the rock beds are again as solid and hard as were those from which the rock particles were torn. The loose earth, which is bread to the nations, is only these same rocks again ground up by water, ice and frost, that they may the better minister to the pressing needs of vegetable life. Now as all the great rock beds or layers have been thrown down by the ocean waves, it is evident to all of you that the lowest of these rocks must be the first formed. We positively know that these rocks are often many miles in thickness. What a signal illustration is this of God's mighty power, and the almost endless train of years in which this power has been exerted. Of course wave power cannot be exerted very deep down—indeed only for a few feet, and so you may well ask how it is that waves of the sea can pile up rocks miles in thickness. This is possible only as the same rocks sink as they rise. All our coasts are unstable to-day. The coasts of Europe skirting the Baltic sea are rising, while those of Greenland and the North American continent from Labrador to New Jersey are as surely being depressed. Just such a slow subsidence has made it possible, all through the world's progress, for the ocean to pile up new made rock beds even for miles in thickness. If we examine the floor of the ocean to-day we find this process of rock building in active progress. We also find that if the water is shallow, as is usually the case with the beach at favorite seaside resorts, then the waves are heavy and thunder against the shore, with resistless force at all times of storms and heavy seas. The waves in such cases will bear along coarse particles, and so in such cases the rock will always be coarse or sand-rock, and often conglomerate. Where the water is deep the force of the waves will be broken, their force lessened, and so only finest rock can be borne by the waves, and so clay rock will be the result. Sea animals, those that form shells, or secrete lime skeletons, like the coral animals, can only thrive in clear, clean water, and so they will slowly build up lime rocks, only where the water is so deep that the force of the waves is not felt, and so no earth particles leave their stain to vex or hinder the sea life in the important work which is given into its hands. Thus we ever find sand formation in shallow water, clay where the water is deeper, and lime where the water is so deep that the sea life is undisturbed by the filth of eroded rock. We know then as we see any rock much of the conditions that looked upon its birth and development. We know that such huge sand-stone cliffs as are seen in the Pictured rocks of Lake Superior were builded on a shallow shore, that the shales which overlie them to the south were as surely thrown down as fine sediment in a deeper sea, while the huge lime masses so often seen in our northern Michigan outcrops were the result of ages of life of sea animals which could thrive only and build up their vast rock beds in a comparatively deep ocean.

We now know that there has been not only gradual progress or development in world building, but in life building as well. At the dawn of the life era were no plants, only the sea weeds, and no animals except the lower forms of sea animals, and as we find to-day, the general style of life was the same in all parts of the world, in fact even more so than now, for as we have already seen the conditions of the world were then more uniform. There was then no polar ice and chill to freeze and drive out most life forms, wherever they could force their deadly presence. Again, later, we find a higher type of life, though many of the lower forms or related forms still hold on. Later, land plants, fishes and other higher forms gave added attractiveness to the then world, as their remains in the rocks which have come to us as the result of the world building of that time positively affirm. Later, huge reptiles—sea, land, and flying reptiles—made the earth a scene of savage ferocity. Soon all our vegetable forms as witnessed to-day, our modern fishes, and the lowest birds and mammals come as the result of that gradual unfolding of life, which under God's laws has ever been going on since the dawn of the creation of life, away back in the indefinite past. Later came our modern birds, and all orders of mammals, some of which were tremendous in size. As we look upon the remains of these huge beasts, much larger and more numerous than to-day, we can well rejoice that in the plans of a loving Father the time of man was not yet.

Last of all, geology shows that man came as the grand finale in this wonderful scheme of development. Now all this knowledge as to the life of the various ages of the world's history comes through the startling revelations made by the rocks. Are we any more sure of the customs of the people who once made noisy the busy streets of Pompeii because Vesuvius flooded that city with the destroying lava since the historic era? The exhumed coins, instruments and very buildings are as faithful a recordas that of the most cautious historian. Aye, often a more reliable witness, as they have no prejudice to bias ; no imagination to add its unreal pictures. Biblical history told of great cities which were lost in the destructive warfare of time. Skeptics would not believe the record, and even used the absence of any remains as argument to invalidate the story itself. Research finds deep under the *debris* of centuries the remains of the handicraft of the old-time people, and disbelief is utterly dethroned. So these unwritten records of the rocks are no fabrication. They form a record as certain as truth, as reliable as fact. On the witness stand they know no prejudice, and never willfully or otherwise forget. Thus these fossils of the rocks, long locked in solid vaults, are now brought forth by man's intelligence and love of truth, and have told their wonderful story, and have in less than one century convinced the world of its entire truthfulness.

Now we see how it is known that our continent commenced in the V-shaped area already referred to, and that Europe as surely arose from an archipelago. These oldest rocks are crystalline, warped and baked, and wholly destitute of fossil remains. They may exhibit no layers which are sure to show in all rocks built up by waves. Hence you can all see and appreciate the kind of testimony which shows that the Upper Peninsula of Michigan reaches back to when time was young. These early rocks were subjected to intense heat which, with moisture, could act upon gold, silver, iron and copper, and by melting and vaporizing these valuable metals could gather them up where they were dropped in smallest particles from the ocean's waters and bear them to some rock fissure or cavern and mass them in quantity as we see them at Marquette and Keweenaw point to-day. So while these old rocks were all unfertilized by the droppings of centuries of life, and while the waves have never been able to plow and harrow them, yet they often are of exceeding value in the costly metals and gems which they hold in their embrace. Tell a geologist of the character of the rocks of our northern Michigan, and he would surely foretell the probable presence of valuable mineral deposits, as did Sir Roderick Murchison the rich gold fields of Australia.

It may be very properly asked how we know what the older, deeper rocks contain, and how we can say that such rocks are miles in thickness. Has man bored to the earth's centre that he can speak of the life, remains and general character of these old rock deposits? There are three ways that we can tell of the important secrets which the old rocks have preserved for all these centuries. Occasionally a river like the Colorado, with its vertical banks a mile in height, has cut its channel through the rocks, thus exposing them to view, and giving to man the key to this geological puzzle. Thus the life remains appear and show a wider and wider divergence from the life type of to-day, as they are exhumed at a greater distance from the surface.

Again we often find, as is so well shown in Pennsylvania, that all the rock strata or layers, which, of course, must have been horizontal when first dropped from the grasp of the ocean waves, have been folded or lifted up by some mighty force as we might fold or push up the centre of many sheets of paper.

Afterwards the ridge or apex of the fold has been worn off by the never ceasing action of the elements. Thus we gain access to the very oldest rocks, and may gather the shells of the old, old seas as easily as we can gather the shells on the shores of our present oceans. Moreover, as the edges of the rock layers are exposed to view by these cosmical foldings and flexures, we can measure the thickness of the rocks as easily as we can pace off the plow land in the pasture or stubble field on our farms. The great upliftings which have made mountains in all parts of the world were either the cause of great heat, or else caused by great heat. The former is doubtless true, and this great heat, as already suggested, has been the great economist that has hunted out the small mineral particles and stored them in the mines. Hence we need never expect to find any considerable amount of the precious metals in the later formed rocks, except in or near great mountain ranges.

The geologist knows that it is as impossible to find gold, silver, and copper in such a region as our Lower Peninsula of Michigan as it is to raise wheat in an undrained black ash swamp, in company with flags and sedges, or to raise good Shorthorns in meager pastures, or on stinted rations. It is an interesting fact that all the truths gleaned from a close study of these folded rocks in all parts of the world are in perfect harmony, and in as perfect accord, with the truths gleaned from a study of the same groups of rocks in such grand canyons as that of the Colorado.

Again, we have already noticed that our continents have been built up around some old time nucleus as around the American V; or nuclei, as about the many old European islands. As the borders were constantly extended, the continent was as constantly raised, and so as the ages passed on more and more of the continents were raised permanently above the encroachments of the ocean waves. Thus, as we come south from the southern shore of Lake Superior, we traverse later and later formed rocks. As already stated the oldest vegetables were wholly marine and consisted entirely of sea weeds. Now in all rocks areas that were raised permanently above the ocean in this time will show in its list of fossils only such plant remains. It is a very significant fact that the successive rock areas from north to south in the Upper Peninsula and northern half of the Lower Peninsula of our State, as also corresponding areas in New York from north to south across the State, show a succession of life forms in exact agreement with that discovered in passing from the highest to the lowest rocks of the river gorge, or in passing from the centre to the outside of a flexture in the mountain upheavals. All these stories of the past life and history of the world are entirely consistent the one with the other, and prove that Geology is treading on solid ground And thus it is, that though storming some of the oldest and most trusted views of the earth and creation, it has gained its point and won universal confidence.

There are three well-marked times in the earth's history as revealed by geological research. First, that when the life was very unlike that of to-day, ancient life time. In that time there were no insects, no bright, flowering plants; the fishes were very old fashion in structure and appearance, and there were no birds and mammals—the highest life being some very curious reptiles, very different from those of to-day. The second time was quite different from the first, and yet quite unlike that of to-day. We call it the middle life time. Though in this time all the classes of animal life which are known to-day were in existence. Yet the mammals and birds were very few, and very different from those now known to us. The principal life at this time was reptilian. And so this middle life time is known as the "Age of Reptiles." These huge reptiles, some of which were 100 feet long, darted swiftly through the sea by means of powerful oar-like tails,—sea reptiles—roamed fearlessly over the land, for they were the monarchs of the time—land mammals—or flew, by means of huge bat-like wings, through forests and over the land—flying reptiles. The few birds of the time had long, bony tails and toothed jaws, and were at most as much like reptiles as like birds. Man and the other higher mammals were wholly absent. The third time includes to-day and showed a higher style of life. While this time shows many of the simpler forms of life which were present in the older times more or less modified, it is very different in the extent and variety of the highest types of life, both animal and vegetable. We call it the recent time or "Age of Mammals." This term is very appropriate, as the mammals are the highest animals, and at this time were very numerous and varied. All these facts, as will be inferred from what has already been stated, have been gathered by a close study of the fossil forms found in the rocks. *All of Michigan was raised above the ocean level at the close of the Ancient time, and so all our rocks belong to that era.* Consequently all the fossil remains which reward the geological tourist and collector of Michigan will be of an old type. Much of our gulf and western territory belongs to the middle life time. While the Atlantic and Gulf shores and not a little of the great western plains belong to the recent time. The collections found on our western confines are wonderful. Skeletons of reptiles over 100 feet have been found in Kansas. While the skeletons of birds and mammals show that a much more varied and extensive life had existed upon our American continent previous to its discovery by Columbus than was found here by the white men who came to take possession. Very likely the red men were active agents in the destruction of the earlier life, as they themselves are being exterminated by the more intelligent invaders —the white men.

Now let us study our own State in the light of what geology has to offer as to its fertility and consequent productiveness; and first let us briefly consider the agents which have ground up and mellowed the rock soil, making it the most important factor in the production of seed time and harvest. You all have observed sufficiently to know that frost and wind alone could not make a deep fertile soil. These agents soon bury the rocks and thus emasculate their own power to mellow and pulverize the earth's strata. Two great agencies have wrought out this great work of erasion and pulverization. The one, the wearing, grinding action of water, we have opportunity to observe and study to-day, after each rain storm. We all know how irresistible this force is. The Colorado chasm, reaching down a mile in depth, tells what a mighty agent it is in the work of cutting into the earth's features and modifying its surface. The present contour of our whole country—aye of the whole world—is as left by the hands of this great sculptor. All the hills, valleys, ravines, gorges which mark the general configuration of our world home, as presented to the eye of the tourist through any of our States or counties, are just as they have been left by this ever working power, running water. As we see the little rill quietly flowing through a considerable valley in almost every large field of the farm, it is hard to believe that the one is the architect of the other. Yet we must remember that the little rill is often swollen into a torrent, and that it has been working for centuries; and thus in the lapse of ages it has been able to scoop out the great valley, and to carry the earth to some lower level. The other force, though a less general one, has been even more active in the past. It is that of moving ice. In Greenland and Switzerland, and even on our own Mount Hood we see this stupendous force in action to-day. The traveler in Switzerland can closely study these ice rivers, the mighty glaciers, and can actually witness their wrenching the rocks asunder, grinding the hardest rocks to very powder, plowing up the rock surface as though it were a mellow soil, and then freezing on to the ground and broken fragments and bearing them on for miles and dropping them as the glaciers melt and so lose their grip. In Greenland the glaciers move down the island and pass into the ocean, and thus arise the tremendous icebergs which are the dread of the mariner even as far south as our own latitude. These icebergs, as they melt, drop their load of Greenland soil, and thus are constantly forming the banks off Newfoundland, where so many a vessel has been wrecked because of these same treacherous rocks; seemingly angry that their own voyage is over, they seek vengeance upon other voyagers. Prof. Agassiz was the first to show that our whole northern latitudes had once been ground, plowed and graded by these same mighty ice rivers. Our own State shows in the yet lingering furrows, in the huge banks of boulder clay, and in the widely scattered hard heads, not one of which had its birthplace this side of the Upper Peninsula, that it was once overspread, plowed and harrowed by these mighty ice plows. Thus we see how nature tilled her soil and prepared it for man's use. These glaciers passed as far south as the Ohio river, and as they melted the ground and broken rock which they held in their grasp was washed along and stranded on the more southern and Gulf States. Michigan, then, has been subjected to the erosive force of both the agents mentioned. The old glaciers acted as the great breaking up and sub-soiling plow which, driven by nature, plowed deep and well. Since the glacial era, running water has been the harrow which has leveled and mellowed, till our State became a very garden spot, which was so well demonstrated by the mighty forest which she grew. This glacier era did not occur till very near our own time; not till towards the close of the recent life time. You will remember that Michigan was completed or raised above the ocean level at the close of the ancient life time. Thus we may say that Michigan was a great fallow, or more properly that she was in permanent pasture for ages. During all this time she was growing richer and richer, for nature in her tillage never sells either coarse or fine crops off the farm. Thus before the eastern border, the Southern and Gulf States, and the great west were in existence, Michigan was the seat of rich herbage and grand forests.

We have already noted how the successive rock areas from oldest to later date in the old life time were deposited and raised above the ocean level from North to South in our Michigan region; we have also seen how these rocks would vary. Some would be sand, some shale, others lime, according as the water during their formation was shallow, deeper, or quite deep. In these successive rock areas in Michigan, some, like the Pictured rocks, were mainly sand rock; others were as peculiarly shale, and still others lime. We may say then that the old rock floor of Michigan was a sort of mosaic, the separate blocks of which were as various as are the rock materials of the earth's crust. We see then that the old glaciers, as they came to load up their huge dirt wagons, had all kinds of rock to shovel, and more had a surface soil to load on that had been enriched by the accumulated deposits of ages upon ages of rich vegetable growths, which had been increasing under the stimulating influence of its own death and decay. We all know that our best soils are most varied in their composition, are well ground up and mellowed, and are well enriched by the accumulated deposits of long ages of growth and decay. Thus we see that our own Michigan in its very geologic history, from the varied rocks which yielded its seed bed from the long ages—all the years of middle and recent geological times—of ever increasing fertilization, through a natural process of green manuring, and from its thorough grinding, stirring, and mixing by the grand ice plows, was destined to become, as we know it has become, one of the most fertile regions of the world. As we have seen, the geologist had only to study the rocks of our Northern Peninsula to predict as did the remarkable and greatly lamented Houghton, that valuable metals would reward the prospector in that part of our State. So likewise the study of the geology of Southern Michigan would make as safe and certain the prediction of a rich and lastingly fertile soil overspreading its broad acres Add to these facts the great bends in the rock strata that formed a permanent resting place for the great lakes which will ever temper the winds of this favored portion of the earth, and we quickly comprehend the magnitude of nature's gifts to us in the wondrous geological formation of our beloved State. As one would suppose, so we know, that agriculturally considered she has no superior.

Before closing this address let me call attention to the fact that the Michigan area in the oldest geologic time was a basin, having its center and deepest portion near the center of the Lower Peninsula. Thus the rock areas representing the different periods from oldest to later, even to the coal bearing rocks, the last formed of the old time life strata, occurs here in rings near the close of this old time life period. This Michigan area, then mostly out of water, became the seat of an inclosed sea, with but a partial and constricted communication with the ocean outside. The rocks forming the floor of this inclosed sea were formed in deep water, and were thus of a shaly or clay formation, and so were impervious to water. Hence for millions of years this central area of Michigan was shut off from the ocean, and as its waters were evaporated the salt and gypsum—plaster—were thrown down. And to this fact we owe the presence of the gypsum and salt deposits which are destined to become more and more a source of wealth to our people. Without the inclosed sea resting for ages upon our fair peninsula, the source of these valuable products would not have existed. Without the clay sub-stratum the salt could not have been withheld. As it is we have a vast mine of salt beneath us, which may be tapped in almost any part of our Southern Peninsula, though at greater and greater expense as we recede from the layer of rocks on which it rests. Later this inclosed sea became drained, and was replaced by the great marsh area, in which the luxuriant vegetation was massed, and afterwards converted into coal. As these coal rocks were the uppermost strata for long ages they were washed by old time streams, and were afterwards torn by the glaciers. So we may never hope to find our coal regions of equal value with those of many other portions of the country. Yet these added to the variety of the rocks from which our soil originated, and may yet become the source of no inconsiderable wealth.

Thus we see that this grand science which opens up so wondrous a history has special interest to Michigan, and especially to the Michigan farmer, for it shows him that the resources, from which spring the generous wealth and prosperity of his State, can not be ephemeral, for they were fixed in the very foundations of the earth. and were considered when the world was *planned.*

Mr. ———: Did all our small boulders come from Lake Superior?

Prof. Cook: Yes; except sandstones, which belong here. All hardheads and granite came from Lake Superior

Mr. ———: Is there such a thing as a stone growing?

Prof. Cook: Yes, in geologic beds.

Query: I mean hardheads, here.

Prof. Cook: No.

President Willits: Could removing stone from the surface injure land?

Prof. Cook: No, unless by affecting its moisture.

President Willits: A Washtenaw county tradition says that removing the stones injures a farm.

Mr. ———: Then why do we get poorer crops now than formerly if it does no harm to remove stones?

Prof. Cook: Growing wheat after wheat. This went along with the removal of the stone, and the result was wrongly assigned to this, instead of to the excessive cropping.

ROADS AND ROADMAKING.

BY MR. T. APPLETON, CIVIL ENGINEER.

[Read before the East Saginaw Institute Feb. 12, 1886.]

Mr. President and Gentlemen of the Farmers' Institute:

In a new district where nearly all the roads are yet to be laid out, great care should be exercised in locating the main roads. In any community there is one point to which most of the heavy traffic goes. This point is the railroad station or the city. It would be well, therefore, to locate the main roads on lines radiating from the business center. These mains roads should not be zigzagged around all the section corners; there is too much waste of travel in following these square corners and too much length of road to maintain. Three or four of these radiating roads may unite in one for the first two or three miles and then diverge on as direct routes as possible. The cross roads, those leading to individual farms or to secondary centers, such as school-houses, stores, etc., can very properly be located on section lines, because it is not necessary to cut up rectangular fields for such roads. But it is an erroneous idea that all roads should be built on section lines. The convenience of the many should not be subject to the whims of the few.

In an older region, where the roads have been laid out and roughly or partially constructed, it would be well before spending any considerable amount of money on improvement of roads to carefully consider whether it would not be advisable to abandon some of the zigzag section line roads and re-locate the main roads on more direct lines. The decisions in these cases will sometimes be embarrassed by buildings, farm improvements, etc., that perhaps ought not to be disturbed, but it would be well to thoroughly weigh the matter, bearing in mind that every rod of distance saved by the direct route will be not only so much saving for every loaded wagon, but also a saving in cost of maintenance and repair. It is often the case that a town has too many roads; more miles of road than are required by a judicious location of roads sufficient to accommodate all the traffic. It may be a difficult and sometimes a delicate matter to decide as to which roads to abandon and how to relocate, but the matter should be considered in a broad, public-spirited way, and a system of roads planned that will best accommodate the greatest number.

It is not necessary to build all the roads at once, nor to make all the changes at once. But by studying out a system of roads, just as this city makes a plan of a system of sewers, every piece of road that is built, and every change of location of a main road, will be an integral part of the system, though it take years to perfect it.

Having determined upon the proper location of the main roads, or upon the portions of the old roads that will be continued, go to work and spend time and labor enough on one section to make so much good road. Indiscriminate patching here and there accomplishes very little. Better spend the whole year's appropriation in one place if necessary to make a good road of it than to half build twice as much distance. Having thoroughly constructed one piece of road one year, the next year's work can be employed on another section of road either adjoining the first or in another district.

In Massachusetts, where I was raised, there is a custom of "working out the highway tax," and I understand the laws are similar here. This is an unsatisfactory and extravagant way of making and repairing roads. There is annually a small convention of citizens, with shovels, hoes, bars, picks, plows, or whatever may be thought necessary in the way of tools, assembled at the appointed rendezvous. They come ostensibly "to work the road." Actually they talk politics, gossip, kill time, and cheat the town. If the pathmaster is a man of good judgment, honest intentions and strong will, he separates the talkers, employs each man on the class of work he is best fitted for, and sees that each man does an honest day's work that is really of some benefit to the town, and in consequence gets defeated at the next election by some person who will be easier on the boys, for "we won't work under no slave driver."

I believe much more good can be accomplished with the same expenditure of money by adopting a contract system. It could be arranged so that those who preferred could pay their taxes in labor instead of money, but if they worked for a contractor they would be more likely to give an honest day's work for their pay. By previously considering the location and character of work it was thought best to do, and clearly defining it, the work could be let out by contract to the lowest bidder. It might be stipulated that the contractor should be a citizen of the town, that he should employ those who lived in the district as laborers, that he should pay certain stipulated wages not less than a certain price. Although handicapped by all these provisions the contractor would be stimulated by a prospective profit for his own pocket, and in handling his work would plan it so as to accomplish the most work with the least labor. He would select the tools, methods and men best adapted to the work in hand. Gossiping and story-telling would be limited to the dinner hour. Every citizen who was thus working out his taxes would be a jealous inspector to see to it that the contractor did just the work he agreed to do, and if it turned out that the contractor really did the work he agreed to and made money on it, at the next contract letting there would be competition enough to keep the price down to reasonable figures.

The proper dimensions of roads, the construction of culverts, the road surface, all these points have been considered and recommendations made time and again. Water, an all-important element, and at times a useful servant to man, is also a persistent enemy to good roads. The natural clay will sustain heavy traffic if dry, but when wet it softens up so that heavily loaded wheels cut into it deeply. Therefore the first requisite of a good road is some means of readily removing water Side ditches should be constructed and the material excavated from the ditches, and if of suitable quality, it should be used in raising the road bed above the water line. But while digging the ditches, outlets should be provided. Gathering the water is not enough; it should be removed so far from the road as to prevent softening the roadway. In some districts the matter of outlets for ditches is a troublesome one. In such cases call in the aid of a surveyor with his level; he can give information in a few hours' work that will enable you to decide upon the best method of disposing of water. Some soils require tile draining to dry them out sufficiently to make a good road surface. The benefits of a good system of tile draining are so well known among you that I will not enlarge upon this point, but will simply say that whenever it is of value to the farm it is of still greater utility to the road.

As eternal vigilance is the price of liberty, so is constant attention the price of good roads. It is not enough to fix the roads over once a year, to put them in repair for one week and allow them to go to rack and ruin for fifty-one weeks in the year. That is the usual method, but it is wasteful and extravagant in the extreme. Constant travel in one track causes ruts; water gathers in the ruts, flows to the lowest point and stops there. This lowest point becomes soft, wheels shuck into it and the slight depression becomes a bad hole in a short time. The water should not be allowed to accumulate, the rut should not be allowed to form. It is much easier to correct these slight imperfections in the beginning than to wait until they become aggravated obstructions. If every man who hauls a load to town would take a hoe or shovel with him, and following his team would fill up a few of the deepest ruts as he goes along, a few minutes' labor of each man every day would accomplish an immense amount of work in a season. When the millenium comes I expect to see every teamster with his hoe filling up the ruts and drawing off the water from the mud puddles, but not before then. It is too much to expect of human nature. I am not going to tramp along fixing up a road for that great lazy neighbor of mine to drive over, who would rather drive his horse and wagon through a mud hole twenty times than get down off his load and draw the water off from the rut. It is not my business to mend the road any more than it is his. But it is the business of every one of us, and there is the trouble. What is everybody's business is nobody's business. Let it be just one person's business, say the pathmaster's, to look after these minor repairs; these little ruts and basins that hold water and cause great chuck holes. Let him go over all the roads in his district at least once a week, and fix up all the little imperfections before they get to be big ones. In a gravelly region there will be projecting stones to be removed. These cobble stones when taken out of the road should not be thrown away; they should be gathered in heaps and broken up with small hammers. This broken stone will make an excellent material for filling chuck holes or for raising the road bed in low or soft places. In his weekly trips the pathmaster should examine all culverts and bridges; oftentimes he will discover the commencement of undermining at a culvert which can be stopped by paving with the stone he has dug out at other points on the road, and thus prevent what, if neglected, would become a serious washout.

If there is no stone or gravel in the district it will be a difficult matter to keep a good road surface. Dirt roads will do in dry weather, but stone or gravel is almost indispensable. If there is no gravel or stone in the town let the authorities buy some. It will be money well expended. I believe that if the subject were placed before the railroad officers in the proper light they would agree to haul gravel and stone for road repairs, if not free of charge, at least for the actual cost. I understand that in some sections of Illinois the railroad companies haul gravel for road repairs free, the town authorities paying merely the cost of loading and unloading. It would be well to pile a few extra loads of gravel at each cross-road intersection, so as to have material on hand for small repairs. A wheelbarrow load of gravel used at the right time will oftentimes save the necessity of using many wagon loads after the road is spoilt.

In closing I would recommend to every one of you to use wide tired wheels. With wide tires every loaded wagon becomes a road roller instead of a road destroyer, as it is with narrow tires. It will avail but little if I get wheels with wide tires while three or four of my neighbors use narrow wheels, for their narrow tires will spoil the road for me, and my wide tires will lift the mud out of the holes made by their narrow ones. But the adoption of wide tires cannot take place all at once, it is a matter of time. Let each man resolve that he will never again buy a narrow-rimmed wheel and in a few years there will be a complete change. It will be awkward and inconvenient at first, but it will soon be fashionable, and the man with narrow tires on his wagon will be looked upon as an old fogy, an enemy to good roads and way behind the times. These wide wheels will have a wonderful effect upon the roads—less labor will be required to keep the roads in shape and greater loads can be hauled. Here is an opportunity for each man to show his public spirit. Don't buy a narrow tired wagon wheel.

Mr. Wm. Webber: Last night Judge Tennant spoke of the enormous cost to the farmer of hauling produce by rail, viz., 1 cent or 1½ cent per ton per mile. Where is the farmer who can haul for himself over country roads for less than 20 cents a ton a mile? I suggest this to emphasize the loss of ordinary roads. I heartily endorse the remarks of the paper relative to wide tires, there is great saving in them.

Mr A. B. Payne: My brother got 6 inch wide tired wagons to haul wheat over the fields, and I used them for hauling wood. I now use 4 inch tires, and a man couldn't give me a narrow tired wagon if I had to use it.

IMPROVEMENT OF MUCK SWAMPS.

BY PROF. R. C. CARPENTER.

PRESENT CONDITION.

The greater portion of the State of Michigan is rolling land, principally gravel or sandy loam, interspersed with swamps. These swamps vary in area from a few square rods to as many square miles; usually, however, they are very small.

The principal drainage needed in the State is for the improvement of such marshes. Large tracts of low lying clay lands are found in the eastern and southeastern parts of the State, from Port Huron to Monroe, and also in various river valleys of the State. Tile drainage has been practiced with thoroughness in the southeastern part of the State, but only to a small extent in other localities. My own impression is, that more miles of tile have been laid in Lenawee and Monroe counties than in all the rest of the State combined.

With regard to the muck swamps, the opinion is prevalent that they can not be converted into valuable land and that any attempts to improve their condition is simply a waste of time and money. This opinion will be found generally based on experiments made twenty or thirty years ago to cultivate these swamps without drainage.

What shall and can be done with our swamps, is a question of a great deal of importance to the farmers of our country. These swamps cover in the aggregate a vast amount of land, which is even to-day, with a few exceptions, waste land which brings no return whatever for the capital invested. In some instances, marshes have been improved to produce grass valuable for pasture or meadow; in still fewer cases they have been so far improved as to produce good crops of grain with equal or even more certainty than the upland surrounding them.

Usually, however, the swamps produce only a luxuriant growth of sedge or rush, a plant of little value as animal food, and so coated on its edges with silica as to be as dangerous to the hands as a piece of broken glass. It is not relished by animals; it is, to a great extent, indigestible, and is only eaten when better food cannot be had.

Probably the only value of the unimproved swamps is for growth of the sedge, or marsh-hay, as it is called, which is of such low feeding value as to be hardly worth storing. Again, many of these swamps are full of dangerous bogs, and there is hardly a farm bordering on such marshes but that can count greater loss caused by stock miring, than gain from the products of the swamp. Who can state the number of valuable animals that have found their fate in the marsh-bogs?

INDIGENOUS TIMBER.

There are some varieties of timber that will grow on these marshes—Tamarack and Arbor Vitae or White Cedar grow in such places. Tamarack will grow and do well on a muck bed fifty or sixty feet deep. White Cedar will grow in swamps that to my own personal knowledge, are dangerous even for a man to pass through. Tamarack seems to flourish best in swamps with stagnant water, and the cedar best in swamps which gives rise to clear spring water. Tamarack, although well adapted for some uses, is generally not regarded as a valuable timber. White Cedar, on the other hand, is our most valued timber for fence posts, telegraph posts and kindred uses. Yet, despite its value, I do not know of any attempt to grow it artificially, and have doubts whether such attempts would be attended with financial success. Trees as a crop, will perhaps never be much in fashion. There are few men who are willing or can afford to sow for their grandchildren to reap—consequently I would not advise the experiment of planting tamarack or white cedar on your marshes.

In swamps where there is little muck, ash, elm and birch are frequently found. The swamps that support such trees, however, hardly come under the head of waste land. Where were originally such swamps are now found the richest portions of our fields.

There are numerous shrubs that grow in swamps, in some cases where the muck is very deep. The willow, huckleberry and various others are usually found in connection with ground more or less swampy.

FINANCIAL CONSIDERATIONS.

It is, however, to the muck swamps that I wish to call your attention to-day. These are the swamps that exist generally in an unimproved condition. The aggregate amount of such swampy land existing to-day in this State is not less than 500,000 acres, and probably it is equally abundant in neighboring States. Could that land, which is now worse than worthless, be improved and brought to such a condition as to produce crops of valuable hay, the aggregate value so added to the property of the State would not be less than $10,000,000.

You see that the question of the improvement of these marshes is certainly worth your consideration from a financial point of view. Throughout the whole State there are but few farms that have not more or less waste land caused by marshes.

These muck swamps, although alike in some particulars, still differ in many others. We find them existing by themselves with or without an outlet for surface waters; we find them along creeks or rivers, and bordering on lakes. The muck of which they are composed varies not only in character, but it exists in varying depths, from a few inches to one hundred feet or more.

FORMATION OF MUCK SWAMPS.

The formation of these swamps is interesting in the extreme. The muck forming the soil of these swamps is vegetable matter that has decayed more or less perfectly, and generally this decay has taken place under water. This class of swamps is not found in the tropical regions. The conditions necessary to form a thick bed of muck are that vegetable growth shall take place faster than it can decay, and such is not the case in the tropics. In the cooler temperate regions, where there is much moisture, the conditions are favorable for such swamps. Even in the Arctic regions such swamps occur.

We will first consider the formation of that class of muck swamps which exists independently of springs or lakes. Start with me in imagination thousands of years ago; the earth we find wooded, and the country somewhat rolling. We note a hollow, but for some cause the outlet is choked, and the waters do not readily run off. A hundred years later—more water in the hollow—many trees have fallen—a dense mass of trees have sprung up, and the trees are being choked out of existence. Still another century and the grass has conquered the trees, successive crop has fallen over successive crop, and the hollow has become a marsh. In subsequent years excavation reveals huge trunks deep in the ground, and man wonders how trees, now indigenous to hard land, or perhaps common to swamps, are found so deeply imbedded in the muck.

It is because the growth of successive years has gradually raised the surface of the land, converting what was once hard land and formerly a valley, into first a swamp which did not afford proper nourishment for trees, and then in time covering with successive vegetable growths any trees that may have fallen over.

The swamp surrounding lakes is formed by successive growths of vegetation which die down, and in their decay form soil for succeeding crops. This growth proceeds from the shore toward the center of the lake, each year adding a concentric ring to that of the year before. The decay under water is necessarily slow, and we frequently find lakes surrounded, and even covered with a floating mass of vegetation—frequently so as not to bear even the weight of a man. Decay and subsequent growth thickens this top, until in time, the deposit may reach the bottom of the lake. That many of our swamps result from the gradual filling of lakes with vegetable matter is proved by the numerous instances on our railroads when overloaded embankments have suddenly disappeared from sight. One case in my own experience is sufficient. When engineer on a railroad in the eastern part of the State, we had occasion to build a heavy embankment about thirty rods in length, across an innocent looking swamp heavily timbered with tamarack. The embankment was built nearly to grade, about twenty feet in height. At night when leaving work it appeared to be all right. The next morning when reaching the swamp, the embankment had nearly disappeared, huge trees by the side were thrown up and toppled over as though exposed to a charge of dynamite. The true cause was this: our swamp had been simply a shell. This we had injudiciously broken through. We applied the only remedy in that case, which was to build up our embankment again and again until it would settle no more. I have known of sink holes so deep that railroads despaired—even with their enormous capital—of ever filling them.

The formation of the marshes bordering springs is not essentially different from that surrounding lakes. In this case, however, we usually have the vegetation growing in clusters or bogs and such holes never lose, from natural causes, their miry condition.

Many a wild animal has rued his temerity in crossing such places. From a bog-swamp near my father's house was obtained the entire skeleton and a huge pair of antlers once belonging to an elk. In the marshes of northern Siberia, in Asia, it is a common occurence to find buried, woolly mastodons, an animal now extinct, but so perfectly preserved that its flesh is edible.

PROPERTIES OF MUCK.

What we term "muck" is known in Ireland, England and Europe generally as "peat" and when dried is used very largely as a fuel. This decayed vegetable matter is often called "humus."

As a fuel, peat is extensively used and is not without value. The value of fuel depends upon the amount of carbon and hydrogen entering into its composition.

The following table gives the principal constituents of certain fuels.

	Peat air dried. Per cent.	Wood air dried. Per cent.	Coal, Soft. Per cent.
Water	8 to 20	20	2 to 10
Ash	5 to 15	1	2 to 14
Carbon	52 to 66	39	56 to 75
Hydrogen	4 to 8	5	5 to 8
Nitrogen	1½ to 3	35	-------
Oxygen	28 to 40	--	6 to 12

The value of manures depend upon the amount of combined nitrogen they contain, which for peat is generally found to be less than 2 per cent. The result of this investigation serves to show that as a fuel, peat possesses much value, but as a manure, very little.

A great difference of opinion is held respecting the value of muck, either as a soil to support improved crops or as a manure for other crops. There may be a reason for this difference of opinion, for, as I have had occasion to point out, there is great difference in the "muck" itself; some of it may be well rotted, other portions may be nothing but a mass of vegetable fibre and hence one may be in shape for use as a manure, the other of no use whatever.

Muck is found in all conditions, from the black, well-rotted vegetable matter to the light-colored moss of inert vegetation. The well-rotted is doubtless of great value as a manure. Dr. Kedzie, in 1876, investigated its manurial properties and I state briefly what he found:

"The black 'cheesy' muck well rotted contains valuable manurial elements. It has great affinity for nitrogen, has the property of drawing heat to the land over which it is spread, increasing heat on clay nearly two degrees, and on sand nearly four degrees. In its natural state it is accompanied with an acid—humic acid—which acts to prevent the growth of many plants. When used as a manure it is of most value when spread out on the ground before the winter's frost. It is disintegrated by the frost which adds much to its value as a m nure."

Muck has a low specific heat, in other words, is heated up rapidly and is cooled rapidly as compared with water.

Thus Schubler found that when dry soil was heated to 145° and allowed to cool down to 70° the time of cooling was in proportion as follows:

Lime sand	100
Quartz	95.6
Clay loam	71.8
Heavy clay	68.4
Muck	49.0
Water	860.4

That is dry muck will heat or cool about twice as fast as sand, one and one-half as fast as clay, and nearly eighteen times as fast as water, by same exposure to heat.

Muck is usually considered a cold soil, but you see from the above investigations, it is proved the warmest of all soils. It owes its bad reputation to the fact that as it naturally exists, it is almost constantly saturated with water. Now water is the element that makes any soil slow to heat. If you allow water to evaporate from your soil, the heat that otherwise would go to nourish plants, will be absorbed and taken from the soil. The evaporation of one inch only of water would deprive your soil of as much heat from each acre as is due to the combustion of 14 tons of coal. If one foot in depth has to be evaporated, the heat drawn from the soil would be the same as that produced by the combustion of 168 tons of coal. Now as muck frequently has more than one foot of water entangled in its particles, there is good reason for its reputation of being cold. Any soil saturated with water for the same reason, is a cold soil, but muck has a peculiar property of absorbing water like a sponge and to such a degree that it literally floats in water. When full of water it is even slower to heat than water itself.

The amount of water that will be absorbed and retained without dripping by 100 pounds of different soils is shown by following results from Schubler:

	Water retained. lbs.	Per cent. of evaporation in 4 hours.
Quartz sand	25	88.4
Lime sand	29	75.9
Clay soil	40	52.0
Heavy clay	61	34.9
Muck	181	25.5
Coarse Peat	377 to 519	

From this it is seen that muck absorbs a great amount of water and loses the same by evaporation very slowly; the coarser its texture the greater its power in that direction.

The necessity of removing the water has I think been clearly shown.

We will no doubt find, however, that in some soils other requirements are equally imperative and I do not claim that drainage alone is the universal panacea that will render your worthless peat bogs into fertile and available soil.

The English, who are cultivating thousands and thousands of acres of peat bogs, find they get excellent results by the application of a coating of clay two or three inches thick. This tends to compact the muck and leaves it in better shape to nourish vegetation. Top dressings of lime or marl or wood ashes are excellent, as they supply many missing qualities for plant growth. But these latter things are expensive and I wish to show that if time be allowed to act, drainage alone will renovate your swamp.

The improvement of those marshes in which the muck is a mass of unrotted moss fiber or tangled roots, is a matter in which to say the least, time is required; until the mass has fully rotted no improvement can take place and none need be expected. Under water, vegetable matter decays very slowly, so that by removing the water the decay will be hastened materially. The results from such a case will not in any event be flattering, and if good results are obtained, drainage must be followed by the application of some material that will tend to decompose the vegetable matter.

There is no doubt but that the muck or peat swamp, as it usually exists, can be converted into a valuable meadow, simply by thorough drainage and the application of natural grass seeds. I will prove this position by actual trials.

DRAINAGE OF SWAMPS AT MICHIGAN AGRICULTURAL COLLEGE.

I will present a case at the College: In the western part of field No. 8 was a large tamarack swamp, which originally covered about six acres. In 1872 this swamp was thoroughly drained. The muck was very deep—at least ten or twelve feet—the drains were laid at a depth of about three and one-half feet. Immediately after being drained the swamp was thrown into the same system of cultivation as the rest of the field, which was a rotation consisting of two clover crops, followed by corn, then roots, and ending with two grain crops, oats followed by wheat.

For two or three years the crops on the muck swamp were not good. Corn always did well; oats at first grew mostly to straw; wheat was first badly winter-killed. For several years, however, the crops from the muck portion of the field have been equally good, and somewhat better than from the remainder of the field. The muck swamp has continually improved until it is fully equal to the remainder of the field in value, and this too without the application of any foreign material. The muck, at first, after being drained and thoroughly dried seemed to lose all its cohesiveness and compactness and it suffered more from a drouth than the upland. It was longer drying out, but when once it was dried out, it seemed to lose its property of imbibing water for some time to come. The work of draining seemed to be overdone. In a few months it, however, began to regain its compactness, and now compares favorably in that respect, with the remainder of the field. The following shows the crops raised in that field as fully as I have been able to find them from the reports.

The crops raised from the 23½ acres including the swamp in field No. 8 are as follows:

Year.	Crop.	Remarks.
1873	Oats, 45 bushels per acre.	
1874	Wheat, 603 bushels; 26.21 per acre. That on peat, heavy straw, and little grain.	
1875	Meadow 60 tons hay.	
1876	Grass meadow, 43 2-3 tons hay.	
1877	Corn, 1,826 bushels ears. Potatoes, 300 bushels.	
1878	Roots, amount not known, but poor.	
1879	Oats, good crop.	
1880	Wheat, good crop.	
1881	Grass, good crop.	
1882	Grass, not known.	
1883	Corn, 349 bushels; failure everywhere.	
1884	Corn, 788 bushels.	

The College has also drained other muck swamps only one of which, and that a very small one, has been subjected to the ordeal of raising grain.

Fields No. 12 and 14, containing about 30 and 40 acres respectively, were at one time largely swamp and marsh. Probably at least 20 acres was a swamp covered with a growth of heavy tamarack and so boggy and miry as to be impassable. A worse swamp is seldom found. Some portions of the swamp were covered with rushes and several inches of water. The muck was very deep, and in 1879 at time of a drouth was very much injured by a fire. The swamp has been open ditched so as to remove most of the surface water since 1876.

The complete system of drains was only finished on this swamp in 1885, but a good part of it has been drained for several years. In this swamp the tile were placed as low as possible, the depth varying from 2½ to 4½ feet. The result of what has been done with this swamp is sufficient to prove that our muck lands may yet be made of value. Already the wild grass and sedge has nearly died out and has been succeeded by June grass, although nothing has been done to clear out the wild grass and get tame started, yet the College already has a pasture of great value.

SWAMP IMPROVEMENT BY FARMERS.

In 1878 I laid out a system of drains for D. L. Case, Esq., of Lansing, the object being to drain a muck swamp containing about thirty acres. This swamp was springy and miry, besides receiving the drainage from considerable land in the vicinity. To secure an adequate outlet, a railroad culvert needed to be lowered about two feet. Considerable difficulty was experienced in getting this done and a temporary drain was laid to the culvert at once. After a delay of about two years the railroad company lowered the culvert, thus giving a good outlet.

The system of drains was completed in 1882. The results have been in every way remarkable, and to most of the people of the vicinity a great surprise. This reclaimed swamp, although in the edge of the city and formerly worthless, is now the most valuable piece of suburban property for gardening near the city of Lansing. Nearly all kinds of vegetables are grown with more certainty and of better quality than on the uplands surrounding.

Mr. C. B. Charles, of Bangor, Mich., has reclaimed 100 acres of muck land, having many miry places, that was formerly wooded with elm, ash, and tamarack timber. A railroad running across a portion of this had to put in piles

120 feet deep to secure a foundation. He now raises corn, oats, and wheat. He seeds his newly cleared swamp in September, sowing six quarts of timothy seed to the acre, whenever it is necessary to seed his meadows, which is about once in six or seven years, as he wishes to have a thick stand of hay. He plows his swamps when wet by fastening a piece of pine plank, 8 by 10 inches, to each horse's foot. This is held in place by a piece of fence wire drawn over the hoof and kept from slipping sideways by the shoe calks.

Mr. Charles has succeeded in raising good crops in all seasons, wet or dry, and found his investment very profitable.

THE CHANDLER FARM.

The "Chandler Swamp" is well known throughout Michigan, from the efforts made to reclaim it by the late Senator Zachariah Chandler.

This swamp, containing about 6,000 acres, is a very difficult one to reclaim. The muck in it is very deep, and before the efforts made by Mr. Chandler to reclaim it, except in very dry weather, was not passable even for a man. The J. L. & S. R. R. traverse a portion of this swamp, and they have had great difficulty in maintaining a road bed. The road bed is supported on the principle of floating rather than being carried by a stable foundation. A train passing over causes a series of waves to run from the track that can be felt for ten rods or more. The track used to be frequently covered with water. I have rode over it when the rails were out of sight for more than a mile. Once a train was derailed, and you can yet see the car tops of that train standing near the track. The cars settled so rapidly in the miry swamp that it was not considered profitable to take them out.

This swamp Mr. Chandler commenced to reclaim in 1868. He experienced unexpected difficulties. First, he imported under contract a large number of men from Holland, who he thought would be valuable for the work of ditching. These men, as soon as in this country, finding wages on railroads higher than offered by Mr. Chandler, left at once and commenced work on the railroad, thus causing considerable loss. He persevered, however, until he finally had about fifteen miles of open drains constructed.

At the time of his death, in 1882, the marsh was commencing to repay the enormous outlay put upon it. Timothy and foul meadow grass had been introduced over nearly the whole tract, and thousands of tons of hay were annually cut. Besides that, good crops of corn and roots were raised on various portions of the marsh. The draining was at best but partially done, the open drains were a long distance apart, and served to remove little more than the surface water. Since his death the open drains have not been kept in good order, and unless a different policy is followed, it is only a question of time when the swamp will return to its original wild condition.

METHODS OF DRAINING MUCK LANDS WITH TILES.

As already remarked, the open ditch is not without value for this purpose, and in case of a wet swamp, an open ditch should always be dug the year preceding the construction of under drains. The muck, when thoroughly wet, occupies much more bulk than when dry and consolidated. The result is that nearly every muck marsh settles after being drained.

The settlement varies with the amount of water, but it is frequently three to six inches and sometimes a foot. This settlement is sufficient to disarrange and sometimes spoil tile drains. The open ditch should be cut down to the full depth that the tiles are to be laid and left open for one season at least.

Those who drain muck for the first time are surprised at the distance apart drains may be placed, provided they cut clear through the muck. If the drains do not cut through the muck the distance apart must be about the same as in clay.

The following maxims are important and should be observed:—

In all cases in draining, the best results are obtained if the source of water supply can be intercepted.

If the marsh is made wet by springs, the best results are obtained by intercepting the springs by the ditch.

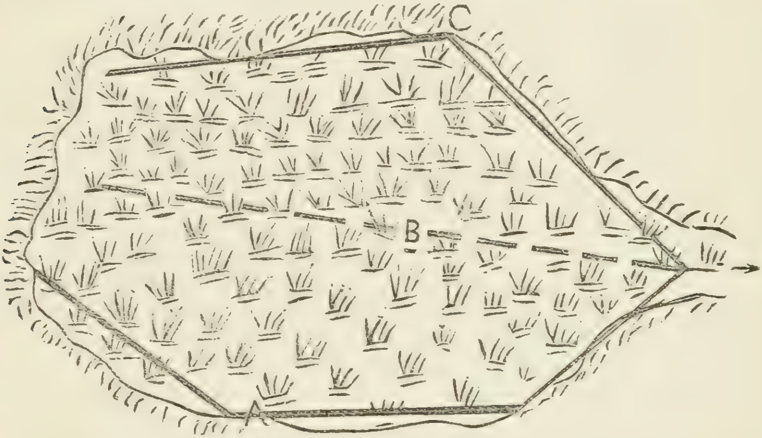


FIG. 1.

As a rule the muck swamp is supplied with water from the side ground or uplands surrounding it. If this be cut off by ditches along the sides the drainage will be complete if the marsh is small.

In large marshes a complete system of main drains and laterals will be needed.

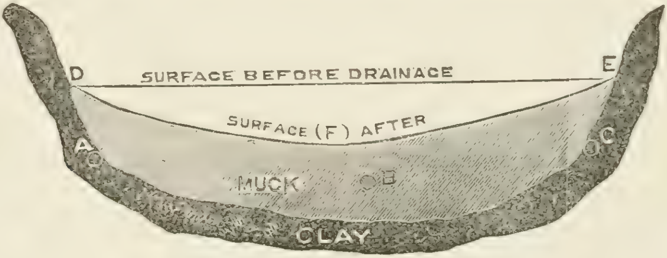


FIG. 2.

Figure 1 illustrates the best location of drains to intercept the flow of water into the basin forming the swamp. A and C are tile drains laid at the edge of the swamp, and B the drain in the center.

Figure 2 shows a cross section of the swamp, showing the drains more effective at A and C than at B. Also lines showing the surface before and after drainage. Also the clay forming the basin.

Tile drains ought not to be laid less than three feet deep in muck, and four feet will give much better results.

SIZE OF TILE.

The grade that can be obtained for tiles in peat swamps is often very small and for that reason it is better to use an extra large size. You had better not use a size less than three inches, for the reason that imperfect laying or sudden settlement is likely to disturb them less; that is, a certain absolute amount, as one-fourth of an inch, will make less difference with a three-inch tile than with a two-inch.

The size of tile for main drain can be found quite accurately by rule that acres drained equal twenty-one and one-third times the square root of the product of the fifth power of the radius of the tile in inches multiplied by the rise, divided by the length.

$$A = 21\tfrac{1}{3}\sqrt{R^5 \tfrac{h}{l}}$$

A = acres.
R = radius of tile in inches.
h = rise.
l = length.

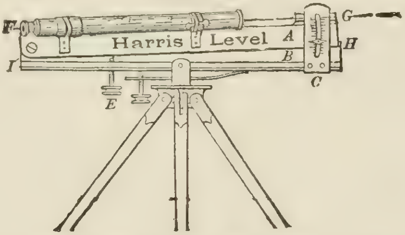
Thus the acres drained by a six-inch tile on a grade that rises 1 foot in 250 feet would be as follows:—

$$A = 21\tfrac{1}{3}\sqrt{3^5\left(\tfrac{1}{250}\right)} = 21\tfrac{1}{3}\sqrt{\tfrac{243}{250}} = \text{about 21 acres.}$$

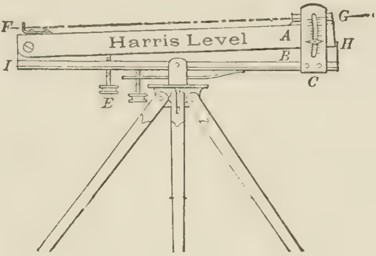
GRADE OF DRAIN.

There should be no uncertainty about this point; in most cases it will pay you to have a level run to decide this point.

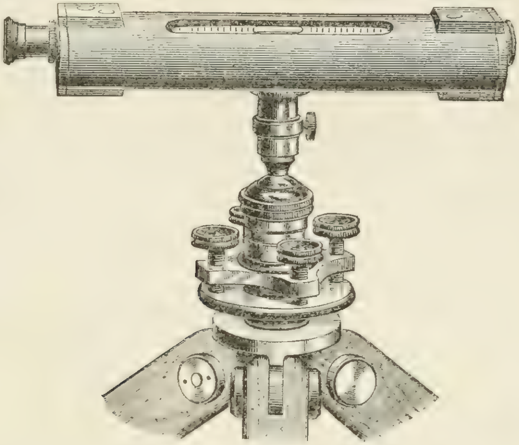
TELESCOPE.



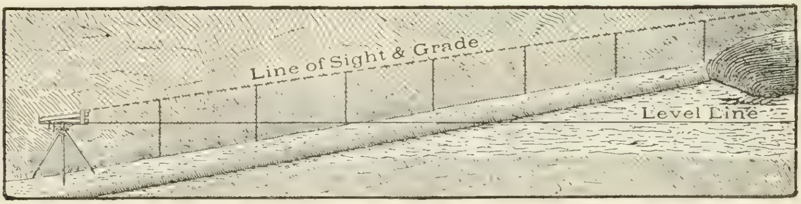
A very simple level is now sold by C. H. Harris, Jackson, Mich., that any man can learn to use in ten minutes, can do good, accurate work with it. The price, with graduated staff or rod, is $10 without telescope, $20 with telescope.



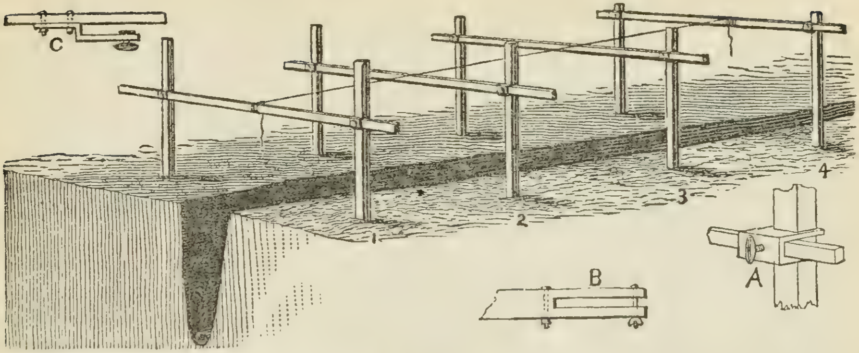
W. & L. E. Gurley, of Troy, N.Y., sell an excellent instrument, as shown below. You can determine the amount of the grade quite accurately with a common carpenter's level as follows:



Drive in two stakes, one each side of your ditch, and near the outlet; nail or fasten securely in a horizontal position a cross piece from stake to stake, and seven feet above the bottom of your ditch. You now have something to work from, and by means of a simple carpenter's level you can now lay out your ditch pretty accurately. Sights, each one-half inch above the level, adds much to its accuracy, as in sighting over a plain surface the eye has to be held somewhat too high, and there is a tendency to look somewhat too low. With the eye alone, an error of one inch in six rods cannot be detected; hence the method to be described is unsafe on a level or nearly level grounds. I think drains in peat ought never to be on a less grade than 1 in 300, which is about two-thirds of an inch per rod.



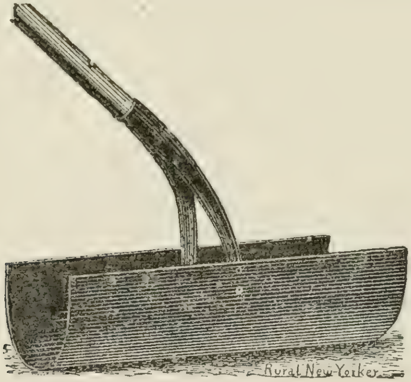
Start at the cross-piece near the outlet, rest a carpenter's level on it, sight up the drain. If the level is three feet high in its first position and it strikes the ground at any point, that ground would be three feet higher than the ground near the level; if it come within one foot of the ground, that ground would be two feet higher; if within four feet, the ground would be one foot lower. In this way an approximate knowledge of the slope of the ground can be obtained.



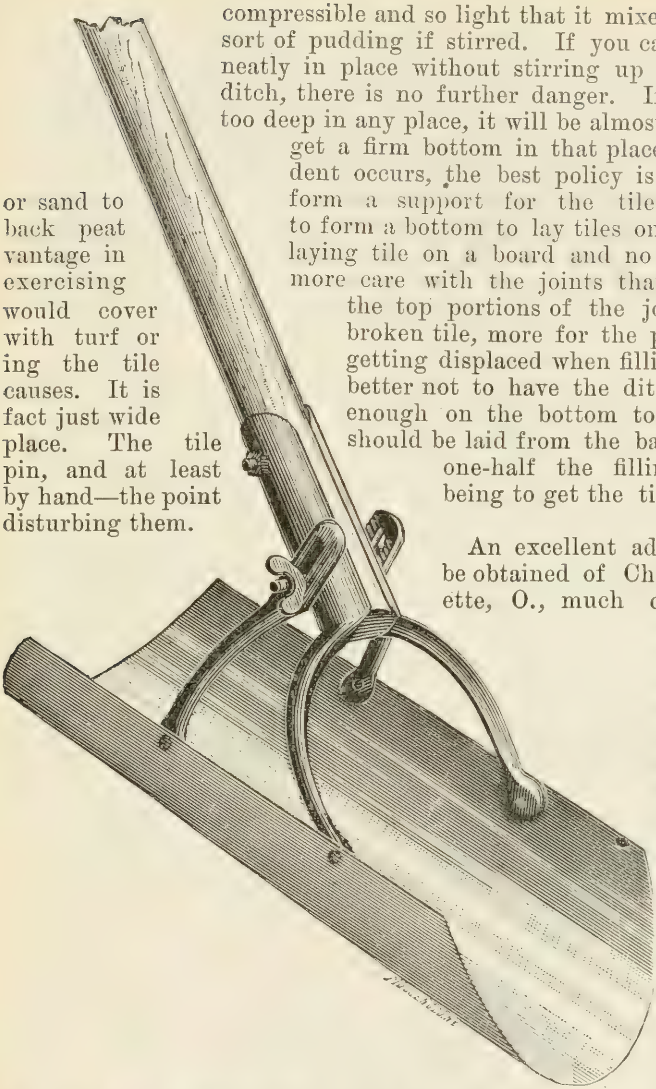
By application of this method a second cross-bar can be set at a turn of the ditch or as far as can be seen, and from there a second, a third, and so on. When the principal bars are set, intermediate ones should be set by sighting once in three rods or thereabouts. Now from bar to bar a string can be stretched tight and this will be parallel to the bottom of the required ditch.

CONSTRUCTION OF THE DRAIN.

After you find out that you have a fall, the next important consideration is to arrange so as to preserve the results of that survey and construct your drain so as to utilize the fall you have. The best means of doing this is to mark a line parallel to the bottom of your ditch and high enough above the ground to be out of the way of the ditchers. If your ditch is to be four feet deep, three above the ground or seven feet above the bottom of the ditch will be sufficient. Measure down a constant amount at each place to secure the correct depth of your ditch. In work with peat the last spading ought not to go within two or three inches of the bottom; a push and pull scoop can be used to finish to grade without danger of making deep holes in the bottom.



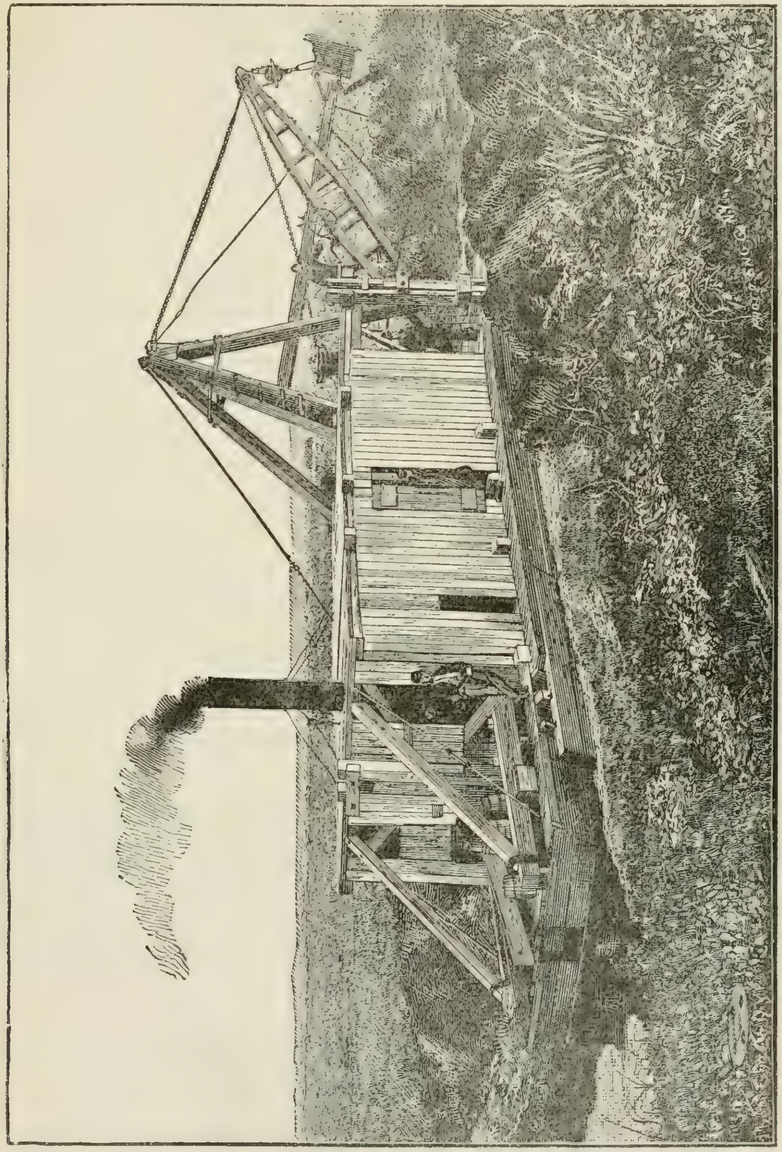
The construction of drains in peat must be done with much more care than on hard land. In the first place, peat is a peculiar substance; it is very compressible and so light that it mixes with water into a sort of pudding if stirred. If you can get the tiles laid neatly in place without stirring up the bottom of the ditch, there is no further danger. If, however, you dig too deep in any place, it will be almost impossible to ever get a firm bottom in that place. If such an accident occurs, the best policy is to carry in gravel or sand to form a support for the tiles. Do not throw back peat to form a bottom to lay tiles on. There is no advantage in laying tile on a board and no particular need of exercising more care with the joints than on other soils. I would cover the top portions of the joints in every case with turf or broken tile, more for the purpose of preventing the tile getting displaced when filling, than from other causes. It is better not to have the ditch any too wide, in fact just wide enough on the bottom to crowd the tile in place. The tile should be laid from the bank with a rod and pin, and at least one-half the filling should be done by hand—the point being to get the tile in place without disturbing them.



An excellent adjustable scoop can be obtained of Chambard Bros., Fayette, O., much cheaper than your blacksmith can make them. These scoops or shovels are the best for that purpose now made, and many hardware stores now keep them in stock. (See cut.)

The mole plow makes quite permanent drains in peaty soils. The channel left by the plow is not permanent in sandy soils, in fact it is of little value, but in clay or peat the channels are quite permanent, and the mole plow affords affords a cheap way of underdraining. Twenty years ago the mole plow was used quite extensively in England and to a certain extent in this country; of late years, however, the demand for it has been limited, and I do not know of any manufacturer engaged in making the simple mole plow. Several patent tile machines use a mole plow which pulls into the ground a string of tiles.

A small steam dredge has given the best satisfaction in building large open ditches in mucky soils. The cut shows one built at Bucyrus, Ohio.



In some instances brush or pole drains have been used on marshes with good success. Such drains, however, are likely to be silted full in a short time unless well protected, and I cannot recommend them for such uses; they will do better on the uplands.

DRAINING BY WELL.

The following example will no doubt prove of interest:

When there is a gravel bed underlying the clay directly beneath the marsh an outlet into the gravel will give excellent results.

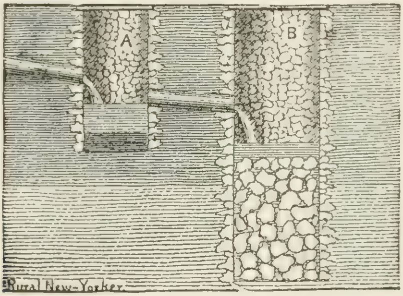
The following from B. F. Welles, C. E., of Marshall, Mich., is a detailed account of drainage by means of drive wells:

There is a small basin or cat-hole along the north side of the Verona road, one mile west of Marshall. It has an area of about two acres, with sloping lands to the extent of twenty-five acres, which shed their waters into it. It is in the S. E. corner of Sec. 22, T. 2 S., R. 6 W. It has nearly always had from one to two feet of water upon it, often rising with heavy rains and flooding the road. There is no way of draining this except by deep cutting. Two years ago in the autumn of 1883, Mr. Geo. Robinson proposed to the owner, Mr. T. Latereoux, to put down a "drive well" at its margin and drain it through that means. A price was agreed upon, conditioned on success.

Mr. R. drove two 2-inch iron tubes 24 feet to rock, which is here a compact sandstone, known to geologists as the Marshall sandstone. At various depths there are water-bearing seams, and Mr. R. believed that if he could pierce one of those water seams it would furnish an outlet for draining the cat-hole. On drilling 16 feet into the rock he struck a seam and at once the water began to flow into this opening. The slime from the pond clogged it after a time, but on applying a pitcher pump the pipe was cleared and the flow went on. He put down a second pipe, this time in the hard ground a little distance from the pond, and cut a ditch and boxed it, with openings covered with fine wire cloth to strain the water and keep back the slum and rubbish. This lowered the water at the rate of about one-half to three-fourths of an inch per 24 hours. The following spring the cat-hole was so dry it might have been plowed; a condition unknown before. The land was lately sold, the purchaser buying it—a lawyer—on the faith that the experiment is successful.

It is apparent to me that the seam in the rocks was of small capacity, and the pipes themselves were smaller than desirable. Where a subterranean outlet can be obtained, I do not see why it is not entirely practicable to drain it this way; though from the nature of the work each case must be an experiment attended with risk of failure."

As Mr. Welles suggests, a large well is much more effective than small drive wells, from its less likelihood to silt up. The most approved construction is shown by cut.



Rural New-Yorker.

SPECIAL CROPS.

It is not my intention to treat of the special crops that succeed on muck soils, although in many cases there is no doubt an unusual opportunity for financial success. In all such cases, however, especial skill is necessary on the part of the producer; and although the temptation may be great to invest largely, it will be safer to resist such temptation and invest only as experience shows a reasonable certainty of success.

For special crops top dressing is ncessary; barn-yard manure adds much to its productiveness. A coating of sand or clay keeps it compact and thereby increases its productive power. A dressing of lime or wood ashes is excellent.

CELERY.

Celery is one of the especial crops that can be grown to perfection on drained muck. For this crop, fertilizers and deep, careful cultivation is needed.

The "celery crop" of Kalamazoo now amounts to thousands of dollars per year, and it is raised on the muck lands bordering the Kalamazoo river. This land a few years ago was considered of scarcely any value; to-day it is worth $300 to $600 per acre.

CRANBERRIES.

This fruit has generally a high market value and is indigenous to muck soils. It needs for its successful production such a control of the water supply that the swamp can be flooded at certain times or drained at others. This crop is very profitable when such conditions can be controlled.

POTATOES.

Potatoes grow well on muck; they are, however, sometimes scabby, but usually fine crops are obtained with no imperfections.

GENERAL CROPS.

The general farm crops can be grown successfully on muck swamps if the swamps are well drained and a high order of cultivation be maintained. As a rule grain crops should be kept off the swamp, at least until it is well subdued. The meadow grasses, timothy or red top, tend to grow very rank and woody if the seed is sown sparsely; on the other hand, excellent hay is produced if the seed is sown thick. June grass is likely to choke out the meadow grasses in this State after a few years, which makes it necessary to reseed.

To plow soft muck land, oxen are sometimes used; but horses do much better, provided they have wooden shoes fastened to their feet. A piece of board 8x12 inches securely bound to the foot with wire has been found to answer well for this purpose. Reseeding can be done, however, without plowing as follows, although this method will not clear the soil from June grass:

In the early spring when the surface alone has thawed out, the bogs may be worked down with a harrow quite easily and the surface made quite smooth. Tame grass seed—timothy and red-top—can then be sowed.

When treated in this way the marsh is not likely to become excessively loose and dry; if it does become so, it may be compacted by rolling or by sheep treading on it. Such an operation is, however, better for the marsh than it is for the sheep. It is not a good plan to plow your marshes expecting thus to make them smooth and compact, until they have been in grass sufficiently long to become compacted. More failures have been made by plowing marshes at once after draining than by any other cause. If sowed to grain at once there is likely to be one or two failures before the soil is sufficiently compact. Grass will do well from the start. After a few years the muck can be plowed and it will produce in time grain as good in quantity and quality as the remainder of your place.

In conclusion, I would say that if you wish to improve your muck swamps the essential is drainage—not merely providing for the escape of the surplus water—but deep and thorough drainage. Experience has amply proved that no course of cropping, of cultivation, or even of fertilizing, is a substitute for draining. While on the other hand numerous cases attest that drainage alone will, in time, convert your worthless swamps into land fitted for the finest meadow, and even in longer time may make the swamp lands suitable for any kind of grain.

I do not know of a single case of failure to improve muck land where the essential drainage was first well done, and then made permanent; but I do know of numerous cases where cultivation of swamp land, without thorough drainage, has resulted only in loss.

President Willits: Does drainage ever hurt land?

Prof. Carpenter: No. The first effect is to leave it very light and porous, but in a few years it settles down and becomes compact.

President Willits: Will drainage put swamp lands in greater danger from fire?

Prof. Carpenter: Swamps will burn with or without drainage if the surface dries. Fire does much hurt to a marsh.

President Alward: Is muck good to apply to other land?

Prof. Carpenter: I would rather leave the muck in its original place and make soil of it by drainage.

Prof. Johnson: Muck is good to compost with barn-yard manure.

President Willits: In Monroe county there were pockets of muck in sandy fields, which were drained and then by scrapers drawn off to the sandy parts and the sand brought back on to the muck, and thus the fields were leveled and both parts of the land improved.

The great cause of disappointment in draining marshes is plowing too soon after draining. It should be sown to grass and left to settle for years before plowing. I have seen marshes that grew nothing but sedge produce 1¾ tons of red top simply after drainage and seeding.

Mr. A. Clark, Secretary West Michigan Farmers' Club: These professors have given us the theory of drainage. Now if they will tell us how to get a drainage law that will hold water, so to speak, they will help us still farther. My soil is heavy clay. I find drainage unquestionably desirable, but at present cost of tile, too great. Can we get tile cheaper? Can we not in our Granges and farmers' organizations devise means of cheapening these things which we see to be so desirable for our farms?

Mr. Graham said he drained a muck swamp, but the crops though growing well did not mature.

Prof. Carpenter: The symptoms indicate more water than the crops could stand. We found wheat least easy to grow on muck.

Mr. ———: Is muck hay as good as other?

Prof. Carpenter: Timothy and red-top raised on muck are as good as any.

Mr. Graham: If muck is deep would you put drains below it?

Prof. Carpenter: If not more than 3 to 5 feet; yes.

Mr. Lester: Would an opening 40 rods from the lower end of a tile drain to admit air facilitate the flow of water?

Prof. Carpenter: Generally there would be no need of it.

Mr. Peabody: What size tile would drain 10 acres with one inch fall per rod?

Prof. Carpenter: Four-inch tile. We drain 50 acres with 8-inch tile, but that is more than ought usually to be expected of 8-inch tile.

Mr. ———: Why does muck hold water when it is used to fill up a tile ditch?

Prof. Carpenter: It has become puddled.

Mr. ———: I think it closes the joints of the tile and so keeps the water out.

Prof. Carpenter: Water usually enters tile from below. It is better that it should do so. We cover joints with sod or broken tile.

Mr. ———: Do you ever place silt basins?

Prof. Carpenter: Yes; but I doubt their value. I think the silt would wash right down through. They are good as observation stations to enable one to see the workings of the drain.

We dig a hole two feet below the line of tile and brick up the sides, putting a 16-inch tile over all. Have the outlet lower than the inlet.

Mr. ———: Is marsh hay good to cover joints of tile?

Prof. Carpenter: Yes; but not as good as sod.

SIZE OF TILE.

BY PROF. R. C. CARPENTER, LANSING, MICH.

There are two things to be considered, first the ability of the tile to carry water, and second the water supply itself, which must be removed. The first consideration has been solved quite accurately as applied to smooth iron pipes, wooden pipes, earthen sewer pipe, and even brick sewers.

The best statement of the case is to be found in Weisbach's large treatise on Mechanics. We will only quote results. The theories give rules with co-efficients depending on experiment, which have been tested extensively by actually measuring the discharge from given pipes, under certain conditions.

The following formula, although not possessing all the refinements of some of the later formulas, is still quite accurate for long lines of pipe. I have tested it myself once with six-inch tile, and once with an inch iron pipe, measuring the discharge. The results were very close indeed to the formula.

Formula for discharge:—

$Q = 39\frac{1}{4}\sqrt{d^5\frac{h}{l}}$

Q = discharge in cubic feet per second.

d = diameter of pipe in feet.
h = rise of pipe.
l = length of pipe.

Expressed as a rule it reads:

To find discharge in cubic feet per second, multiply rise divided by length by fifth power of diameter expressed in feet, extract square root of this product, and multiply this result by 39¼.

EXAMPLE.—Find discharge in cubic feet per second, tile 1 foot diameter, running full, fall divided by length equal $\frac{1}{100}$. In this case $Q = 39\frac{1}{4}\sqrt{\frac{1}{100}} = 3.9$.

This formula may be reduced to a more useful form, in which we have discharge in 24 hours instead of each second, in which case

$V = 6780\sqrt{D^5\frac{h}{l}}$
V = discharge in cubic feet each 24 hours.
D = diameter of tile in inches.
$\frac{h}{l}$ = rise divided by length.

If water one-half inch in depth were standing over one acre of land, it would amount to 1815 cubic feet.

By dividing above co-efficient by this amount we have

$$A = 3.8\sqrt{D^5\frac{h}{l}}$$

In which A equals number of acres from which tile will remove water of one-half inch in depth during 24 hours.

The table following the article is computed from a formula somewhat more accurate than the above, but the difference will in any case hardly be sensible.

WATER TO BE REMOVED.

The capacity of the tile must be made dependent on this consideration, and this varies in somewhat wide limits. If the rainfall is the only factor involved, the difference in different localities is not as great as one would on first consideration suspect; the variation is probably in no case as great as the variation in the annual rainfall. In case of water from other sources just so much additional capacity must be given the drains.

The annual rainfall is of very little importance in this consideration from the fact that our drains to be of service must be able to remove the excess of water much oftener than once per year.

Suppose the annual rainfall to be about 36 inches or one-tenth of an inch per day; if then the capacity of our drains were sufficient to remove this water, it might be thought that we should get good results. This would increase the capacity given in the table five times. I have known systems of drains to be put in on this plan, and although the investment was small for tile, still so far as any returns were concerned, it was thrown away. Agricultural crops do not flourish unless the water can be removed within a certain definite time after it falls. That period varies for different crops, and under different systems of cultivation, but my observation leads me to believe, it is not profitable to have this period longer than twenty-four hours.

After long periods of drouth, the soil retains for a long time all the water that falls upon it. Again during excessive wet weather, it gives off as much as falls. Numerous experiments have been made to test the absorptive powers of the soil; it varies very much with the soil and its condition, running from 10 to 90 per cent. and over, of the weight of the soil.

Drainage to be entirely successful must not depend to any extent whatever on evaporation; that process removes heat from the soil and is consequently hurtful to a great degree for most crops.

Again drainage is of no value unless it frees the ground from surface water during a wet time—the dry weather does not tax the drains, nor are they especially needed at that time. It is seen from these considerations that our drains must have a large reserve capacity; they must be of size to remove the greatest excess of water that can reasonably be expected day by day, yet we cannot afford to build drains for rain storms that come only once or twice a year, because the absorption of the water by the soil will possibly render such excess harmless.

The important point to be borne in mind, is, that the factor which influences the size of the tile is not the annual rainfall but rather the excess above what is retained by the earth, which is brought down in heavy rainfalls within short periods of time. In our locality we usually have, between March and November, about twenty showers, in each of which more than one inch of water falls within a period less than 24 hours. We have only about three with rainfall of $1\frac{1}{2}$ inch and one with a rainfall exceeding 3 inches, while we may expect 285 showers with rainfall less than one inch.

A long study of these considerations lead me to believe that the carrying capacity of our drains should be sufficient to remove one-half inch of water from the whole surface drained each day of 24 hours. I also believe that there are but few places in the United States, or in any other place, where agricultural drainage is wanted but that drains of equal capacity will be needed.

CAPACITY OF TILE DRAINS AS COMPARED WITH OPEN DITCHES.

It is generally believed that for equal areas of cross section of water, the tile drain has much greater capacity than the open ditch. This notion is, I am sorry to say, founded on neither reason nor experiment, and the simple act of measuring the flow in two such cases would soon convince a person of such error. The retardation to the flow is caused by friction on the sides, and this is much worse in ordinary cases for tile drains than for open ditches.

OPEN DRAINS.

An approximate formula for flow of water in open ditches, which has been found by experiment to give accurate results in ditch practice is:

$$Q = a\sqrt{\frac{9000\,f}{P}}$$

Q=Cubic feet discharged per second.

a=area of section of water in square feet.

f=fall divided by distance.

P=Wetted perimeter.

Example—Find discharge of ditch one foot wide on bottom, one foot deep; slope of sides, 45°; fall, one foot in 100.

$$\text{In this case}\left\{\begin{array}{l} a=2 \\ f=\frac{1}{100} \\ P=3.82 \\ Q=9.7 \end{array}\right.$$

Compare this with 12 inch tile drain.

The capacity in this case is nearly four times as great, while the area is only about 2⅔ times as great.

The following table for capacity of open drains was computed from the formula mentioned by B. F. Wells, C. E., of Marshall, Mich.

The following is a selection of only a few quantities given in an extensive table. (Table is published in full in "Bellow's Surveying.")

TABLE—*Acres from which one-half inch of water will be removed by open drain within 24 hours—side slope, 45°. Drain full.*

Fall in Feet per		Width on Bottom.					
Mile.	100 Feet.	One Foot.		Two Feet.		Three Feet.	
		Two Feet Deep.	Three Feet Deep.	Two Feet Deep.	Three Feet Deep.	Two Feet Deep.	Three Feet Deep.
1.6	.030	407	981	594	1,311	780	1,649
2.8	.053	553	1,319	797	1,762	1,053	2,217
4.0	.076	666	1,590	959	2,115	1,264	2,665
6.4	.120	852	2,030	1,225	2,700	1,612	3,401
8.0	.150	956	2,273	1,373	3,031	1,809	3,815

The fall that can be secured where open drains are laid, very seldom exceeds eight feet per mile and usually is not in excess of four feet per mile.

TABLE FOR SIZE OF TILE.

Rate of Inclination.		Acres Drained (or from which ½ inch in depth of water is removed per day.)						
Rise. (Exact.)	Rise in Inches per Rod. (Approximate.)	2-inch Tile.	3-inch Tile.	4-inch Tile.	6-inch Tile.	8-inch Tile.	10-inch Tile.	12-inch Tile.
1 ft. in 10 ft.	20 in. to 1 rod	6.6	18.9	--------	--------	--------	--------	--------
1 " " 20 "	10 " " 1 "	4.7	13.0	26.8	--------	--------	--------	--------
1 " " 25 "	8 " " 1 "	4.2	11.4	24.0	66.2	--------	--------	--------
1 " " 30 "	6 ⅓ " " 1 "	3.9	10.9	21.9	61.5	126.4	--------	--------
1 " " 40 "	5 " " 1 "	3.4	9.4	19.0	53.3	109.6	190 5	--------
1 " " 50 "	4 " " 1 "	3.0	8.4	17.0	47.7	98.0	170.4	269.0
1 " " 60 "	3 ⅓ " " 1 "	2.7	7.6	15.6	43.4	90.0	156.0	246.0
1 " " 70 "	3 " " 1 "	2.5	6.9	14.5	39.9	83.0	144.4	228.1
1 " " 80 "	2 ½ " " 1 "	2.3	6.5	13.4	37.2	77.0	135.0	213.0
1 " " 90 "	2 ¼ " " 1 "	2.2	6.1	12.6	35.0	72.5	127.0	200.5
1 " " 100 "	2 " " 1 "	2.0	5.7	11.9	33.1	69.2	120.6	190.5
1 " " 150 "	1 ⅓ " " 1 "	1.6	4.5	9.5	26.6	56.0	97.3	154.4
1 " " 200 "	1 " " 1 "	--------	3.9	8.2	22.8	48.0	38.9	132.5
1 " " 250 "	4-5 " " 1 "	--------	3.5	7.5	20.4	43.4	74.4	117.0
1 " " 300 "	⅔ " " 1 "	--------	--------	6.9	18.4	38.2	65.5	107.0
1 " " 400 "	½ " " 1 "	--------	--------	5.9	16.5	34.6	60.3	90.7
1 " " 500 "	2-5 " " 1 "	--------	--------	5.3	14.8	30.1	54.0	81.6
1 " " 600 "	⅓ " " 1 "	--------	--------	4.8	13.3	28.0	48.6	74.0
1 " " 800 "	¼ " " 1 "	--------	--------	4.1	11.4	24.0	41.9	65.0
1 " " 1,000 "	1-5 " " 1 "	--------	--------	--------	10.2	21.2	37.2	56.0
1 " " 1,500 "	2-15 " " 1 "	--------	--------	--------	8.7	17.6	30.8	47.0
1 " " 2,000 "	1-10 " " 1 "	--------	--------	--------	--------	--------	27.0	40.8

NOTE—One acre covered with one-half inch of water is equivalent to 1,815 cubic feet. Capacity of drain is expressed in cubic feet per day by multiplying each number by 1,815. If tiles are laid to grades where numbers are not given, extraordinary caution must be used.

Approximate formula:

$$A = 3.8\sqrt{D^{5}\frac{h}{l}} \quad \begin{cases} A = \text{acres drained.} \\ D = \text{diameter of tile in inches.} \\ h = \text{rise.} \\ l = \text{length.} \end{cases}$$

WHAT SHALL WE DO WITH OUR PEATY SOILS AFTER DRAINAGE?

BY W. ASA ROWE, OF AURELIUS.

[A paper read before the Ingham County Farmers' Club Institute, at Mason, Friday, Feb. 6, 1886.]

How shall we treat our swampy, mucky soils after drainage? This is a question that many of us are interested in at the present time. Immense tracts of this class of land lie all about us, and probably one-half of the farms of Ingham county have more or less of it upon them. We have arrived at that stage in the development of the country where other lands are largely cleared up and improved, and now have time to begin work on these unsightly places, these eyesores of the community and breeders of innumerable diseases, these places which will cause any of us to take our friends the long way around to our homes when they make us a first visit, so that they may not see them and form an unfavorable impression of our country at first.

During the past few years great activity has been shown in draining these lands. A little over a year ago I noticed in a neighboring county paper 14 different drains advertised to let at one time by a single township drain commissioner. I speak of this only as showing what is being done or has been accomplished, and as an indication that it is fully time to discuss the after-treatment of these lands.

Some few people have an idea that after drainage the swamps will be ready to be tilled and used about as other lands, while others know by dearly bought experience that this is not so.

A very common impression in regard to swampy land is, that it is naturally the richest part of the farm, or that if it were not for the water it would be the best part of the farm, but those who have tried them know that if they are to cord up the wealth contained in a swamp, even after it is pretty thoroughly drained, it must be in some other way than by following the old upland rotation of corn, oats, wheat, and clover.

Some of the things to be considered in working with swampy land are:

1st. They are by location inclined to be frosty. Cold air, like cold water, settles to the lowest points attainable, like the hollows where our swamps usually are, so that a chilly night, such as we frequently have in summer, which leaves vegetation unharmed on upland, may, and frequently does, freeze and destroy crops in these places.

2d. Another peculiarity which tends to still further lower the temperature of swampy ground is that at night it rapidly parts with the heat stored up during the day, so that a plant growing on peat would freeze much sooner than one growing on some other kind of soil in the same position. By experience it has been shown that humus cools as much in one and three-fourths hours as clay loam in two and one-half hours.

These are serious drawbacks and must be kept in mind or Dame Nature will assert her supremacy by destroying in a single night that which we have labored weeks or months to grow. We can not hope to change the location, but perhaps we may change the texture, of the soil so that it will not radiate heat so fast, and thus help matters some.

3d. A third peculiarity of peat is that when it once becomes thoroughly wet, as during winter and spring, it dries out very slowly and being so full of water renders it cold and unfit for most crops until late in spring. It not only parts with its capillary water more slowly than other soils but has more of it to part with, and this still further retards the time when it may safely be planted or sown.

A dry soil will be 12 to 14 degrees warmer than a wet one at the same time.

Trying to warm up peat or muck holding two or three times its own weight of water is like trying to boil water by building a fire on top of the kettle, rather slow business.

4th. When once thoroughly dry, peat lies up loosely and a light rain runs through it as through a sieve, and so in times of drouth, unless the rain be very heavy, it seems to do no good. This will more especially affect young plants as a new seedling, the roots of which are near the surface, while plants that are fully established may have roots long enough to reach the bottom water which may nearly always be found a little below the drains. Then, too, when dry, peat heats up very rapidly in the day time and thus further aggravates the drouth. There is no half way business about muck, whatever peculiarity it has at all it has very strong or a little too much. When frosty it is too frosty, when wet it is too wet, (and this with capillary water which the drains will not remove), when dry it is too dry.

5th. When wet, as in spring and fall, it contains so much water as to heave badly by the freezing and thawing. A drained soil heaves out plants by freezing nearly in proportion to the amount of water held by capillary attraction, and peat holds more water in this way than any other soil we have.

6th. It is very loose and light when dry and does not hold the plants firmly enough. Plants blow over easily, thus injuring the crop. A good soil is mellow but still firm enough to hold the plants as to prevent the the wind from breaking the roots and overturning the plants. Corn growgrowing on mucky soil, or any tall growing crop, is very much injured in this maner.

7th. When first drained it usually contains some acids injurious to vegetation and these acids must be neutralized or in some way disposed of before many of our cultivated plants will grow. These acids ordinarily may easily be killed by weathering, that is turning the soil up and leaving it exposed to the weather for a longer or shorter period of time. Occasionally we find a swamp that persistently remains barren after drainage and this usually because it is so sour or contains so much acid. To reclaim such a piece of land here at the present time would probably cost as much or more than the land would afterwards be worth. In England heavy limeing is practiced.

Lastly. Although the peat of our swampy lands is simply decomposed vegetable matter, yet the change has usually gone on under water, so that unlike barnyard manure it is not a complete plant food. Some elements of plant food are inert or else lacking entirely, and wherever the vegetable matter is so deep that a plow will not turn up more or less traces of other soil below, experience has shown that the addition of other substances as manures are of great value. A load of common earth spread upon the surface of a deep muck may and frequently does do more good than a load of the best barnyard manure upon an upland field.

In all our dealing with swampy land in preparing to crop, it is well to make haste slowly, to begin with a small parcel on an average portion and try a few experiments before plunging headlong into the work.

In all our work with peaty soils, after drainage we have first to ask, How far can I, with the means at hand and with due regard to the profits, make additions to this land and supply lacking plant food and do away with or overcome the bad qualities of which I have already spoken? And, second, what crops that will be profitable can I raise that will not be likely to be injured by the frost, the heaving, or the drouth?

In England, where labor is cheap and help plenty, they go to great trouble and expense in reclaiming bog lands. Paring and burning the surface, limeing, sanding, claying, trenching and bringing up marl from the bottom of the trenches to leave on top of the land, and even going so far as almost to build a soil on top of the bog land. All of these processes are so expensive that we cannot think of adopting them, nor do I believe it is necessary to do so in order to get fairly profitable results with many crops.

Any one who has ever cut hay on such land must have noticed the greater luxuriance of growth in spots where droppings of cattle and horses have been scattered. This shows plainly that a coating of barnyard manure here will pay as well or better than on an upland.

Ashes are excellent, as they not only furnish plant food but compact the soil and this packing of the soil is one great thing to be always kept in view. Dirt of any kind may almost always be used with profit. Even a very thin coating working wonders.

But we must remember that the muck in many of our swamps is so shallow that the plow brings up soil here and there, or the craw-fish bring it to the surface, and where there is much of this I would not expect any great good from the addition of soil.

The crop best adapted to these soils is grass for pasture. When once well seeded to June grass and red top the sod acts as a shield and they neither heave nor dry out very badly, and are very profitable as pastures, giving much feed and continuing through the season. For timothy hay they are very good, but the frost nips the tops once in a while.

The great trouble is to get a catch. If the seed is sown too late in spring the drouth kills it and in the fall freezing kills it. I have known some persons to sow rye with the grass seed to protect the young grass plants. Only a very small amount of rye was used and it seemed to work well. A good rolling also helps very much. Millett and Hungarian seem to do well if a sprinkling of manure or dirt has been added.

They say it is just the place for celery. Turnips and other roots grow very well, but are apt to be poor keepers and must be harvested early to prevent freezing. They are also inclined to grow up to leaves and do not form as smooth and nice a root as on upland soils. Cabbages and some other garden crops do very well. If corn is planted it should be an early maturing variety, and even then we need not be surprised if the frost instead of our stock gets the crop.

Unless we can manure very heavily with sand, clay, lime or ashes, it is hardly possible to grow oats, barley or wheat with profit on such lands. They are not and never will be grain lands and must usually be managed as stock farms. Where this is done we may expect some profit besides the satisfaction of removing the unsightly places and rendering the country more healthful.

In conclusion I admit that I have not made a very ornamental showing for these lands, but it is better to know the facts as they are and adjust ourselves and our methods to the land than to drive ahead without knowledge or thought and fail. I believe there is profit in reclaiming our swamp land with all its drawbacks. I have already put some money in such work and every year am putting in more, but if I am ever to get fully repaid for this work I think it will be by putting more stock on the farm to consume and grow upon the crops produced and not by the direct sale of the crops themselves.

THE WILDS OF MICHIGAN.

BY MR. G. H. CANNON.

[Read at the Rochester Institute, February 5, 1886.]

Ladies and Gentlemen:

The field to which I invite your attention is a large one, and only a general view can be given. For many years I have had much to do, in my line of business, with the wilderness portions of our State, either as a government land surveyor, or in explorations for minerals and timber, and in this line of duty have traversed its length and breadth, in all directions, throughout the Lower as well as the Upper Peninsulas, with more or less of minuteness; what I have to say will, therefore, be based largely upon personal observation. The situation of our State is peculiar, held, as it were, in the embrace of immense bodies of water. The contour of its lake coast, together with its marked physical features, are such that an impression remains upon the mind not easily removed. One is seldom at a loss to remember the exterior boundaries of the two peninsulas which comprise our State, they are so unlike any other in our Union. We propose, in order to gain an idea of its size, to take you along the border of its great lakes, outline its coast, and with a birdseye view of its interior, leave you, as we hope, to think more and more of "Michigan, our Michigan." We may appropriately select as our starting point the extreme western border of the Upper Peninsula, the boundary line between Wisconsin and Michigan, where the Montreal River, with a single fall of 100 feet, pours its dark colored flood into the clear waters of Lake Superior. This being so marked a feature of the lake shore we shall not be likely to miss it when on the return. Following now the trend of the shore eastward, making around the peninsula of Keweenaw point, skirting along the Pictured Rocks and that wonderful pile of ever shifting sand, the Grand Sauble, in and out of deep bays, along the rapids of the St. Mary's River, until we reach the waters of Lake Huron, where at Point Detour we have made the extreme eastern portion of the main land. We may now change our direction, and following the coast westward, wetting our feet in the waters of Lakes Huron and Michigan, along a shore devoid of special interest, so unlike the Lake Superior border, until we arrive at the mouth of the Menominee River. Ascending this river and its west branch, some 170 miles, we reach the land boundary. Following this for 65 miles, and passing the Lake of the Wilderness, we reach the upper forks of the

Montreal River. Descending this stream a distance of 34 miles, with numerous falls and rapids, making 804 feet of descent, we come to our place of beginning.

In this route we have traversed upwards of 800 miles of lake coast, 200 of river, and only some 65 miles of land boundary; we have, however, enclosed an area of considerably more than 16,000 square miles.

With a step of four miles across the narrowest point of the Straits of Mackinaw we touch the northernmost apex of the Lower Peninsula and stand upon historic ground. Looking now to the southward we may straighten out our legs 280 miles, and turning our feet at right angles along the Ohio and Indiana lines, span a distance of 170 miles in an east and west direction; while one arm, with a moderate length of fish line, extends along 400 miles of western lake coast, and the other crooked over the Huron Peninsula measures 600 miles to the Ohio line.

This ideal man with the jaunty cap of the Upper Peninsula on his head which is, perhaps, a little bulging on the off ear, on account of the largest copper and iron mines in the world, can use the commerce of the lakes and defy all competition.

Grouping now the two peninsulas we have a total area of 59,000 square miles or 37,760,000 acres. The whole of this area is not to be considered as all land, as we have about 6,000 lakes or ponds, some of which are of considerable size, and also a few meandered rivers. These will form an area of about 1,000,000 of acres. We may also deduct from the sum total 13,000,000 acres now in farms (numbering 132,000), of which not less than 8,000,000 acres are improved. We have, therefore, remaining 24,000,000 acres not classed into farms, and 5,000,000 unimproved in existing farms. From the most reliable data at hand it is found that the farms of our State average a little more than 90 acres each. Upon this basis we have land enough left to make 265,000 farms. Probably the time will come when Michigan will count within her borders no less than 500,000 farms. In this review we have not directly considered the many islands within the confines of our State, some of which are of large size; these would add materially to the land surface. It is not to be understood that all the land comprised in this vast tract is good for farming purposes, as there may be found large spaces of light sand and extensive swamps and marshes. But so much remains, that one need not go out of the State to seek a home or to find plenty of wild land. One should hesitate long before emigrating elsewhere, especially to the treeless and blizzard swept plains of the West. A cabin in the woods of Michigan looks to us far more comfortable, with its well lighted interior, and its cheery hardwood fire.

Bitter disappointment is apt to meet those who seek to make a home elsewhere, after once living in Michigan. We know of many families who were in comfortable circumstances, but thinking to better themselves elsewhere, sold out their homes and emigrated to the South and West, only to return after two or three years, very much poorer and a little wiser, to begin again the struggle of building a home under adverse circumstances. The fact is, none need go out of this State to do well. If a person is really anxious to own a home of his own, it can be had in Michigan much better than elsewhere; if he be already married so much the better.

The settler can now be within easy reach of the main lines of communication wherever he may wish to locate. This large area of unoccupied land has practically passed from the hands of the government, which holds, I believe, less than 1,000,000 of acres, while the amount held by the State is inconsiderable. Individuals and corporations hold the balance. In looking over this unoccupied territory we cannot go into details, as the time at our disposal is too limited. Beginning at the eastern border of the Upper Peninsula, midway between the Straits of Mackinaw and the falls of St. Mary's River, traveling westward, we find ourselves in what is known as the "burnt lands." These occupy an extensive plateau of many townships. The original forest, for the most part, has been swept off by fearful fires which raged over this whole eastern portion, many years ago. The surface is covered with a rank growth of grass, while limited groves of small poplars and white birch, with patches of willow and clumps of fir, cedar, hemlock and pine are interspersed throughout this region.

One often sees in the valleys or along the margins of streams, American elms, which have escaped the fires, standing out, sometimes solitary and alone, sometimes in groups, giving to the landscape, with its graceful, drooping branches, a park-like appearance. The sub-soil over this entire region is a rich red clay, and on the surface usually a clay loam, a strong, good soil, which only awaits stirring into life, and exposure to frost and sunshine, to produce immense crops, of all the cereals and grasses adapted to the climate. This portion of the peninsula is but sparsely settled; it is nowhere elevated more than 250 feet above the waters of the great lakes, and abounds in many swift-flowing streams. It is well watered and admirably adapted for grazing purposes. Continuing westward we pass over a diversified surface, and note not a few cedar swamps of valuable timber and large tracts of excellent hardwood lands, that are often interspersed with groves of pine and hemlock. The surface of the country is rolling, especially along the Lake Superior slope, where the streams are short and rapid, the water shed or divide being near that lake, while the region south of the divide is more nearly level or undulating, with numerous streams, some of considerable size; here we find extensive marshes, many of them containing bog iron ore, also fine reaches of blue-joint meadow grass, much prized by the pioneer and lumberman, as it makes good hay. Many of those natural meadows may be found along the Tahquamenaw River. As we approach the mineral region, and traverse the western portion of the peninsula, the region is more rolling and broken, ranges of rocky hills abound, and we are reminded of a mountainous country, but these elevations nowhere exceed 1,400 feet above the lake. It is here that the iron and copper mines are found. The soil all through this portion is good, and there is much hard-wood timber, especially about Agogebic Lake and the Montreal River. Fine groves of sugar maples, yellow birch, basswood and elm may here be found, with some oak, ironwood, soft maple and cherry intermixed. There is also a generous sprinkling of evergreen trees all through the region. It is a well watered and well timbered country, and thought to be far superior, for farming purposes, to much of the New England States, to some portions of which it bears a great resemblance. The granite and trap rocks, which abound in this portion, are bare over but small areas; the soil is warm and quick, the timber tall, large and of thrifty growth. The surface is often quite stony and is varied and interesting. As yet but little has been done to develop its agricultural resources, and away from the vicinity of the mines there are but few settlers. As a new iron region of great promise is being opened near the Montreal River, it is believed that settlers will speedily occupy the soil.

Turning to the Lower Peninsula, the wilderness portion that now remains lies more particularly north of the Saginaws and the mouth of the Muskegon River. In all the region northward to the Straits no extensive forests of very many miles now remain. The cabin of the pioneer can be found in every county, though the field that yet remains to be occupied is very large. We have, as a striking characteristic of many portions of the peninsula, extensive sandy plains or pine openings. This class of land occupies many thousands of acres, being conspicuous in Ogemaw, Oscoda, Crawford, and Montmorency counties, and along the Muskegon, Manistee, and Au Sable Rivers. The surface of these sandy plains is usually undulating or gently rolling, with broad swells, and is quite free from large timber; patches of small, low topped, limby pines at times appear, which resemble, in the distance, an apple orchard. This class of lands, now being occupied, is found to be fairly productive, and it is believed will make fine farms. The western slope of the peninsula, as you approach the Straits of Mackinaw, is a rolling, hard wood country, the soil a sandy or gravelly loam, with a subsoil of clay, only in limited portions. The eastern slope, though somewhat similar in character in most features, contains in addition many swamps, with much cedar, hemlock, and pine. There are also extensive plains and a great deal of good hard wood land. Immense groves of pine are scattered through the Peninsula, which has furnished for many years more than a thousand million feet of lumber annually to the markets of the world. These groves of pine are usually mixed with the hard wood timber, and the soil where they grow found to be productive.

We may now mention a few of the islands which are found in the corporate limits of our State. In Lake Michigan we have the Manitous, Beavers, and St. Helena; at the Straits, the Islands of Mackinaw and Bois Blanc; approaching the St. Mary's River we have Drummond Island, with many smaller ones along the stream. In Lake Superior we name only Grand Island and Isle Royale, the latter being the largest of them all. The island is situated near the national boundary line, not far from the north shore of Lake Superior. It is an island of singular interest; once the home of the ancient copper miner, now, for the most part, a barren, rocky region, deeply cut by bays, and gemmed by small lakes. In the narrow valleys or along the hills and ridges, there is a mixture of maple, birch, spruce, fir, and pine; the vegetation is not heavy although the soil is good. The island is rugged and broken in its outline. "Bold cliffs of columnar trap and castellated rock with mural escarpments sternly present themselves to the surf and defy the storm." It is not desirable for settlement, and is, I believe, practically unoccupied. Mackinaw Island, rising 300 feet out of the water, is a place of great interest, and is now a national park. The remaining islands, especially the Manitous and Beavers, are hard wood timbered land and largely occupied.

We have now taken a hasty glance at the wild portion of our State, and it may not be amiss as we close this sketch, to note its different phases with the change of seasons. Nowhere are these more pronounced than in the forest. The autumn gales and early frosts have despoiled the deciduous trees of their foliage, the wild flowers, once so plenty in the woods, have disappeared,—winter has come; the lakes and rivers are closed with ice,—the earth is white with snow, its recent falling has lodged among the pine needles and in the foliage of the hemlock, fir and cedar, often in such quantities that the lower branches, bending beneath its weight, lie upon the ground, while the upper ones, in diminished length, resting upon these, form a cone of purest snow. A white mantle envelops all. At times a change occurs in the temperature, the wind blows with great velocity, the air is filled with swirling masses of driven snow; the tops of the great trees sway and bend before the blast, their branches are often hurled to the ground; the forest creaks and groans with the tempest; the storm at length ceases, the snow cones have disappeared, the white mantle of the tree tops has vanished; the tall colonades of trees stand out from the border of the openings, or on the hills, leafless against the leaden sky, while the deep green foliage of the pine, hemlock and fir form to the scenery a background of great beauty. Such in winter, the wilderness becomes impressive in its solitude and loneliness.

A gradual change occurs: the snow and ice disappear in the openings, it lingers longer in the shade as if loth to leave, vegetation is bursting into life, the starry petals of the trailing arbutus look out from its snowy covering, with the first dawning of spring, nestled among the pine-covered hills or along the sunny slopes of the sandy ridges; this first and loveliest of all the early flowers disappears as the leaves expand, giving place to a great variety of flowering plants, which carpet the earth in early summer; they are found in profusion on the warmer soils of the hardwood lands; their presence is a source of pleasure and a striking feature of the wilderness; they linger until late in the fall and disappear with the early frosts. As the summer develops the forest becomes a mass of living green, it is no longer silent, myriads of insect life fill the air with their constant hum; night settles down on the wilderness; the long howl of the wolf is often heard, echoed by the mournful notes of the loon, calling to his mate, from the distant lake. The owl from his lofty perch, joins the general chorus, and disturbs the solitude of night, while the evening and morning is vocal with the melody of feathered songsters. The moon, half hidden by the foliage of immense trees, casts uncertain shadows in the openings. Such, in summer, the wilderness becomes impressive in its diversity and grandeur.

DIVERSITIES IN NATURE.

BY ROBERT URE.

[Farmers' Institute at East Saginaw, February 12, 1886.]

The individuality of every animal, of every plant, of every seed, of every leaf, is as distinct and separate as are the individualities of the human family, each having the general characteristics of its kind, and the distinctive peculiarities of itself.

It has been found that every wheat plant has one superior head, and every head one superior kernel, and by continuous persistence in planting these superior selections and in careful cultivation the standard can be maintained for a length of time, how long I cannot say, for many of us know of a wheat that once had hardly an equal for its liberal yield and excellent quality, which after a time became so demoralized that it disappeared, notwithstanding the extra efforts that were put forth to tide it over its inevitable fate. On the other hand we see occasionally new varieties making their appearance. "Sports?" but if that which is asserted in the January number of the Century magazine be true, that the wheat plant is self-fertilizing and completely protected from contact with pollen from other flowers, how do these occasional specimens originate?

Professor Folen, in his inaugural discourse at Cambridge in 1831 said: "Jacob, in his dream, wrestling with the Lord of Heaven and earth, bearing off in his lameness a revelation of Omnipotence, is the true emblem of German philosophy." So, in like manner do we come limping back, with the meager revelations made to us, as we wrestle with nature, and seek solutions in philosophy. Do we turn to the animal kingdom? The same tendency is as clearly apparent. In the improved breeds of horses, cattle, sheep and swine, the best efforts that man is capable of putting into action have been and are being put forth to breed these creatures up to an ideal standard; nature disputes the ground step by step, pointing back to the normal state of these creatures, and were it not for the ability that is in man to concentrate his efforts to a single point, utter disappointment would be the result.

I have now in my mind the case of a man who thought he fancied the Jersey cow, and purchased some of them, and as he saw them in his large pastures day after day, the thought occurred to him, that by judicious management he might make a great improvement in his stock. He commenced crossing with the Shorthorn, but it was unsatisfactory; he changed to some other breed, with results no better, he then went back to the Jerseys; the results were worse and worse, for they looked neither like Jerseys nor anything else. He has sold them all, and now proposes to commence anew.

I was not a little surprised the other day, while trying to select four sugar beets from a pile of forty or fifty bushels, that I could not find four that looked alike; in size and contour they nearly resembled each other, but there was no trouble to see wherein they differed; and the thought suggested itself to my mind: can there be as much difference in the matter that constitutes these several beets, as there is in their external appearance? Are not all sugar beets alike? or is there about the same difference in the internal structure and composition of each as there is in their external appearance? If there is, can you tell me how to select a good sugar beet, as I could tell you how to select a good cow for milk, a good sheep for mutton or wool, or a good horse for work.

Many of the vegetables grown in the garden, especially parsnips and carrots, when allowed to seed themselves and follow the bent of their own inclination, soon triumphantly disport themselves in their true character, viz., as noxious weeds. It is man's prerogative to develop them to an indefinite point of excellence, and, paradoxical as it may appear, nature assists man in his efforts to improve and develop, and at the same time asserts her privilege of holding them to their normal condition.

The transmutation of wheat into chess I shall pass by, because only those who know something about it believe in it.

Now one thing more, and that is in regard to fruit. Why is it that some of the choicest varieties in sections not far remote from us are so inferior when planted here? If I take the scions and put them in good, healthy, thrifty tops, can they help themselves? I can only answer, they do; and not only that, but before they give it up they generally kill the tree that they are put into.

In December, 1875, I attended a meeting of the State Pomological Society at Jackson, and among the many interesting and instructive questions considered, was one on pears. The facts were these: A Mr. Brown and a Mr. Robinson joined farms, their houses were but a little way from the line fence that divided them, and they decided to plant their orchards between the line fence and their houses. They sent together for the same kinds of trees, divided them, and assisted each other in planting them out. They took good care of these trees, but with Mr. Robinson they were a complete failure, while with Mr. Brown they were all that could be desired. Finally Mr. Brown undertook the management of Mr. Robinson's pear trees, determined to make them come to time or know the reason, but had to give them up, as thoroughly nonplussed as his neighbor.

Here the thought comes in—and I leave it for you to elaborate—Man is in the same boat with the rest of the organic creation. Christian civilization and culture are lifting him up; something in his nature rebels, and has a downward tendency. A restoring power and influence outside of himself keeps him from sinking down. The Indians have it all in a nutshell; they say: "It's easy to make an Indian out of a white man, but it's pretty hard work to make a white man out of an Indian."

Mr. Ure: Is there as much difference in beets inside as outside?

Dr. Kedzie: They vary very much. Sugar makers refuse to take extra large beets. They are less saccharine—more water and wood.

Mr. Ure: Then small beets are better feed for cattle?

Dr. Kedzie: Better than extra big ones.

Mr. Geddes: Sugar makers prefer, too, beets that grow as much underground as may be.

LET THE SECRET OUT.

BY MRS. L. E. CANNON, WASHINGTON, MICH.

[Read at the Rochester Institute, Feb. 4, 1886.]

Then love and joy and hope should smile
In the farmer's household all the while.
Let the farmer's wife receive her share
Of loving thought and tender care.
Tell her you *love* her; many a weary wife
Would find the heart-ache lifted from her life
If the dear husband—loving her—no doubt—
Would only *sometimes* let the secret out.
You think she knows it, that's enough, you say,
And where's the good of telling her each day
Those simple words, "I love you," when you said
Them o'er and o'er again the day you wed.
But do you never think that women's hearts
Are like the tender plant or grass that starts
So fresh and full of life? Suppose the rain
Should deluge them in spring time, then refrain.
Suppose the blessed dew, that falls each night
And sinks into their hearts with morning light,
Should say, "I'm such a little, trifling thing
That after all the rain they had in spring,
Thep hardly need my little offering."
How would we find the tiny, fragile flower

Needing the moisture every day and hour?
Only a withered, dried up, dying thing,
Just like the shriveled hearts to which we cling.
Is there a fountain of perpetual youth?
Then *love* must be its source. We find, in truth,
The loving hearts are those that ne'er grow old,
For love will treasures give not bought with gold.

THE FARMER'S WIFE MAY BE A LADY.

BY MRS. E. W. TREAT, OF COLDWATER, MICH.

[Read at the Quincy Institute Feb. 17, 1886.]

Is there anything in being a farmer's wife that should blunt a woman's natural love of the beautiful in art or nature, or rob her of inborn qualities that go to make a real lady?

What constitutes a real lady? Surely it is not jewels, silks and laces, but qualities of heart and mind, pleasant words and graces. Surely it does not depend upon the mere accident of position, nor the possession of literary acquirements. One might be a queen as far as position goes, and still be coarse, and one may be a farmer's wife and still be a lady. We often read such statements as this, "No lady will allow a napkin to be used at her table the second time without being laundried." As that would make in the average family about eight dozen napkins every week, it excludes most of us from being ladies. Webster tells us a lady is one who has charge of the domestic affairs of a household, which would include most of us. The sense in which it is most generally used is his further definition, "A woman of refined manners."

I would prefer the definition, "A woman of refined feelings," for one may, by being educated and accustomed to good society, acquire elegant and refined manners, and still lack the inborn qualities of a lady. In short, when we have found a true woman, we have not far to go to find a lady, be she rich or poor.

I do not suppose there is anyone whose home is, or has been, in the country, who will say that there is anything in being a farmer's wife that should blunt or mar our better nature, or keep us from being ladies.

I often think when watching the sky at sunrise or sunset, or when riding in the free, pure air past fields of growing crops, that there is no class whose opportunities are so good for leading pure lives, and who should live so near to nature's God as farmers; but while I believe this, I also know that there are many things which, if we allow them to, will blunt our love of the beautiful, and rob us of the qualities that go to make a lady. There are very many who have inborn the qualities of ladyhood whose lives are such that these qualities are crushed and choked, and their natures soured and hardened, and it would almost seem that there is no help for it.

"And the world looks on, and never guesses
The sounds that would be sweet and grand
If the master keys could only answer
To the touch of a master hand."

The poetry that is written of farmers' wives is usually about like this:

"Oh give me the life of the farmer's wife,
In the fields and woods so bright,
'Mong the singing birds. and the lowing herds,
And the clover blossoms white.
The note of the morning's heavenward lark
Is the music sweet for me,
And the dewy flowers in the morning hours
The gems I love to see."

How true to life! though taken from the farmer's own paper, the Grange Visitor. How many of us are in the fields and woods so bright, 'mong the singing birds and the clover blossoms white? The most of us are in a hot kitchen, hurrying with all our might in the early hours instead of among the dewy flowers. But after all, should not this poetry be nearer the truth than it is? I know that few of us enjoy the peace and beauty of our surroundings as we might. "He that hath no inward beauty sees none, though all around is beautiful," but I do not know as it follows that she has no inward beauty who sees none in her surroundings. Many of us do not seem to think it right to pause in the busy day to listen to the birds singing in our shade trees (if we have any) or to musingly watch the rain or note the development of the foliage around our homes—things which should be such a source of pleasure to us.

I fear we do not value our position as we ought. We should feel that, as the country home is the support of the nation, it is there should be found its purest, truest women, a goodly share of its ladies. We must do away with the idea that we must get away from the farm, away from the harvesting, threshing, butchering and sausage, and have nicer work and less of it before we can be ladies. Let us feel that to fill well our place, be it where it may, to be a true woman, to add dignity to labor, is to be a lady; for the refinement of feeling, which is the first essential of the true lady, finds a much broader field in which to manifest itself in the narrow circle of home than in society where there is so much less to cause friction; and it is this friction which must come into the lives of us all, that tries our souls. But let us try to remember that the great event of to-day is usually but a trifle in the memory of to-morrow.

Farmers do not realize, I am sure, many of them, how much they can help their wives to gain and hold that patience, that contentment, which enables them to be pleasant and ladylike through all the cares that press upon them and well nigh rob them of these qualities. How few of us but have seen days when we were so tired and overworked and so much was to be done that we felt all but ready to sink beneath the load, and hardly felt like answering a civil question, when our husband has stopped a moment on his way through the kitchen, to pump a pail of water for us perhaps, and to say he was sorry the threshers came just then, and how the load was lifted, how bright was the sunshine, how much more pleasantly we could speak, how much more like a lady we felt than a moment before; for "dearer than the lover's praise" are the words which tell a wife her work is appreciated, for, as George Eliot has said, "It is hard to believe long together that anything is worth while unless there is some eye to kindle in common with our own, some brief word uttered now and then to imply that what is precious to us is precious alike to another mind."

I believe we may say a lady is one who "suffereth long and is kind," a lady is not "easily provoked, beareth all things, believeth all things, endureth all things." But it is hard to be all this when we are overworked and half sick. Often, rest and medicine will do more to make ladies of us than a sermon or a book on etiquette. We may, as no once else can, absorb into our own being the strength of the hills, the peace of the sky and the patience of the earth: let us not lose all these in a vain attempt to grasp,—not the best things of life but some of its merest externals, adding to all our labors and getting nothing that is worth having in return. Let us pay no regard to any slight put upon us by those who have nothing to do but amuse themselves. Oh! that every one of us, farmers and farmers' wives, would repeat, as often as we are in danger of repining or wishing our lot other than it is, these beautiful words of Francis Kemble, "A sacred burden is this life ye bear, look on it, lift it, bear it solemnly, stand up and walk beneath it steadfastly." I know no words more full of strength, and help, and meaning than these:

Let us remember that day by day we are making our destiny, day by day we are choosing our habits, our traits, our homes, or, as Longfellow so beautifully puts it:

Nothing useless is, or low,
Each thing in its place is best,
And what seems but idle show
Strengthens and supports the rest.

For the structure that we raise,
Time is with material filled;
Our to-days, and yesterdays
Are the blocks with which we build.

In the elder days of art,
Builders wrought with greatest care
Each minute and unseen part,
For the gods see everywhere.

Let us do our work as well,
Both the unseen and the seen;
Make the house where gods may dwell
Beautiful, entire, and clean.

Else our lives are incomplete,
Standing in these walls of time,
Broken stairways where the feet
Stumble as they seek to climb.

Prof. Cook: The best of most homes is the woman in the home. We hear of men promising to "love, honor and cherish," and their wives get up, make the fires, get breakfast and then call the men! Such men furnish their wives green poplar wood to burn!

THE SOCIAL RANK OF FARMERS.

BY HON. M. D. CAMPBELL.

[Read at the Quincy Institute, Feb. 18, 1886.]

Mr. President, Ladies and Gentlemen:

Why your committee asked me to address a Farmers' Institute has been something of a mystery to me and may prove more of one to you ere I am done with my paper. I suppose it was because my growing years were passed within rail fences, and my young voice was early attuned to the *Whee-co-boss* or *ko-da* of rural life. But though I know how long it takes butter to come in an old dash churn, and which is the bunting end of a hungry calf, I nevertheless know but very little of the great science, farming; and so allow me to assure you in advance, that I am not a teacher of farmers. In the short time I have been able to give the subject, I have found not the least of my difficulties to get a definition of the term "social rank" as understood in this our boasted republic. We know what it meant in the South a few years ago. We read what it means in the old world where lords, knights, serfs and vassals are ranked as such. We know what it means in England and Ireland with the tillers of the soil, where they are little more than slaves to their masters. We know what it means in France, where the largest farm tilled by its owner is not more than eleven acres. But when we undertake to formulate a definition that will clearly define American social rank, either as applied to agriculture or other vocations, we find ourselves in more than a peck of trouble. Our farmers of to-day are not living upon the soil of many generations of their fathers, for but a few scores of years at most have elapsed, since our ancestors broke loose from the attachments of their native countries, to find a home in America. They crossed the seas to stake out a home from which no lord of mammon could drive them away. Thus the old definitions of social rank, as applied to agriculture, must gather new meanings from the ages and countries in which they are used. In the older States of our commonwealth the towns and small cities have become so thickly scattered over the country, that we can hardly get out of sight of the village church spire, or away from the sound of the village school bell. The farmers and towns people have married and inter-married, until the separating lines would be hard to trace. The villages of to-day are largely made up of the farmers of yesterday. Some have drifted from their farms to the village or city store, or to homes in the village to educate their children, or in declining years or failing health to find more leisure than the cares of the farm will permit. And I do not believe there are very many boys or girls who have thus come to maturity on the farm, and whose early lives and growth have been assimilated from its surroundings, but that will, so long as life and reason last, point with pride to the home of their youth. In the cities and villages are to be found the extremes of wealth and poverty. Only a few, however, are rich, while the great mass are the poorest of the nation. But on the farms of the country we find the great middle class. That class who are neither within the tropical luxuriant growth, where massive fortunes shine down upon them, nor yet cling to the barren rocks in the frigid zone of poverty.

I trust no one will think I am hoodwinked or blinded to the fact that we have in society, caste and rank. If there are any who believe that we have not, they are those who have never felt the elbows of their neighbors, like battering rams, plying away at their floating ribs. If you believe we have not, go with me and ask the poor boy whose patched pants and stone bruised feet have been the butt of his schoolmate's jeers. Ask those girls whose hands have become browned by the dishwater and washing, and whose keen sensibilities have so often been cut with the slights and taunts of their dandy, whitehanded neighbors. Go and ask the poor man, as he comes from our church door, in what or whose pew he found a sitting. In spite of the declaration that "we hold all men to be born free and equal," a large silver spoon in the mouth of a baby will help to tip the beam of our American scales.

Social rank with us is of two kinds, that which is real and that which is assumed. The real is that which is built upon inherent worth. It is composed of morality, intelligence, perseverance, and other qualities that go to make up a man. It matters not whether he was born of royal blood, or whether his father came from the bogs of Ireland in the hold of a ship, and has carried the mortar hod all his days. Real worth is not intruding. It does not go about with a brass band, nor advertise itself like an open bottle of camphor. It is rather the sunshine that we see streaming out of the good and noble deeds of men and women. It is the influence of good mothers, whose golden precepts and advice and example are the pictures that hang upon the walls of memory. It is the influence for good that has come from the hovel, as well as from the palace.

An assumed social rank is that which glitters most and has the least substance. You may see it in a silk umbrella, being walked all around by a moustache and a pair of skin-tight pants. You can see it in that woman whose rustling skirts are drawn up close, and whose chin angles a little upward when she finds some poor woman of the town seated in her pew; in boys and girls, and some of larger growth, whose passport contains nothing but the honorable stations their fathers have occupied. But it is with gratitude to our institutions, and the common sense that has preserved them, that the happy fact is recorded that massive fortunes are seldom inherited, and the blood of royalty never. The millionaires of the country are the poor boys of a few years since, and the wealthy of the past are now represented in name by men of average means, or the poorest in our midst. The sons and daughters of honorable parents who were high in distinction, and for whom the parental cloak formed a warm garment in youth, we now find shivering in the cold wind of public opinion, unless they are filling well the niche they occupy by their own exertions.

Thus far has my paper touched but lightly a few notes upon the keyboard of modern society. But for a moment or so I would ask you to consider the farmers social rank under two heads:—First, collectively, and Second, individually. By collectively I mean that it is not simply a privilege which farmers have to protect and advance their own interests by united effort, but that it is also a duty which they owe their profession, their posterity, and their country. Not that duty points to an aggressive warfare upon other trades and occupations; but in a republican form of government, where man is a sovereign, and where every interest must find within itself its own advancement and defence, I believe it to be as truly a duty for any honorable pursuit to guard its well being by individual or united effort, as it is for the loyal citizen to stand between his country and its enemies. The honor of agriculture is nowhere questioned, but the rank it shall take in the list of callings will in the future depend much upon the united efforts of those who follow it. Nearly all the great national questions of the day are those resting upon the farms of the country, and their ultimate good or evil will be for you to reap or suffer. While this is true, there should be none more interested than the farmer himself in the legislation and government under which he must live. And he who drives with official reins, and forgets the man whose morning call is the breaking sunlight streaming over the eastern hills, whose hands are calloused by the plow, and whose music is the song of the reaper and lowing herds, is he who should be forgotten in the growth of his ambition, when his name appears in caucus or at the polls.

If farmers would elevate their calling as such, they must as farmers assert their strength, prove their sovereignity by the power they can wield in church and state, to advance their common ideas.

The desire for wealth is no crime, and it is almost, if not quite, universal. But when wealth becomes so richly attired that the farmer, in his overalls and blouse, is only noticed when the interest upon his mortgage is due or just before an election, it can be understood that the stony heart of that fortune at least does not beat in sympathy with the interests of the farmer, and when it is better understood, as it soon will be by all political parties, that nominees are not always to be chosen by the amount of campaign boodle they can furnish, just that soon, whether the lesson shall come from the farmers, from the Knights of Labor, or from whatever source, will wealth be made to understand that it must wear other than aristocracy spectacles upon week days as well as upon Sundays. And just so soon also will the farmers, or others who teach the lesson, be raised collectively to the social rank which they in their power have asserted.

I would gladly carry these thoughts further did time permit, but I must stop to touch lightly upon the social rank of farmers as individuals.

Wealth as a single ingredient does not elevate socially among farmers as in other vocations of life, though perhaps the one most potent factor. Let fathers and mothers not toil so hard to acquire lands and money for their children. But rather let them fill well the granaries of their children's minds with seeds that may be sown in the soil of any business when lands and money have failed. I believe the child should be encouraged in one or more terms at the village or city school when it is possible. It gives better advantages for higher instruction. It gives more independence of character, less of undue reverence which country children sometimes ascribe to village or city bred people, an association with life in other phases, and a social criticism that after years may never furnish. The table of every farmer should be supplied with one or more newspapers, that both he and his family may breathe the fresh air of intelligence which they will bring into his house. They should be wholesome, and if but a single paper can be taken, it should be the local journal. The tastes of the children should be considered in the selection. They should contain fiction that is pure, but be free from the stories of blood, thunder, trainwreckers, and Indians.

Farmers should be cautious of large indebtedness in these days, if they expect to pay it from the produce of their farm. Prices are too low, and interest is a cancer eating too fast, for the average man to encumber his farm for half its value and expect his land to raise the encumbrance, support him and family, and pay the annual interest. The man who undertakes it usually fails in the end, while he makes himself a slave in his long struggle. While thus walking under the cloud of debt, the bonnet his wife wears, the garments with which his children are clad, the carriage in which they ride, have attached to them the neighborhood label, "He's in debt for all he's worth." His daily walk is under the shadow of these remarks, and he imagines many more that are never said.

A costless, but valuable adornment, that will win its way in every honorable calling in life is courtesy; children should be taught its principles and made to practice true courtesy and good manners as early as their a, b, c. Another mark of social standing and rank in the farmer is cleanliness. By this is not meant that the farmer should be free from the sweat, the dust, and the soil in which he labors, but it is meant that no farmer is so poor that three hundred and sixty-five days in every year must find him with a dirty shirt. Water is so free, and factory and calico so cheap, that a change of clothing can now and then sever the material connection of barn and house. While there are very few to whom this would apply, yet there are those in almost every community whose influence, like Grand Rapid's plaster, is a better fertilizer among vegetation than in society.

Now and then are found farmers who make the highway in front of their house, their wood pile, and their front yard a hog pasture. It may be the latter is done because of the excuse rendered by the Irishman, "Because it contains all the convaniences for a pig." Bat these, with many other un-American ways of doing, have their influence upon the social standing of those farmers who practice them, if not upon the profession.

In conclusicn allow me to say that social rank in America is not created by self-assumption. Tho shallow pated dudes, their sisters and wives who have grown up between brick walls, and know not the difference between a pig and a rabbit, who define the farmer as some one has defined the mule, "with no pride of ancestry nor hope of posterity," are themselves but parrots playing in some father's cage, and whose prattle is heard with as much amusement. But the real and genuine social caste which comes from more enduring qualities, and which is better appreciated as intelligence and common sense increase, is a caste and rank that we may court and encourage. Some kind of social rank always has and always will exist, and since no legislating, lawing, or coaxing can drive it out, it becomes every station to accept the situation as it is, and to keep as far in advance of the ambulance wagon and as near the front rank as possible.

The social caste of farmers will be both collectively and individually the dignity they give their calling by the epaulets they place upon their own shoulders. And I believe the day is not far distant when from city and hamlet, from woodland, vale, and glen, will arise in unbroken harmony, a chorus to those fireplace words of Robert Burns: —

What tho' on homely fare we dine,
Wear hoddin grey and a' that,
Gie fools their silks and knaves their wine,
A man's a man for a' that,
For a' that and a' that
Their tinsel show and a' that,
The honest man tho' e'er sae poor,
Is king o' men for a' that.

BOOK FARMING.

MRS. J. C. WILSON.

[Read at the Rochester Institute, Feb. 5, 1886.]

The farmer is much inclined to underrate the profession of which he is a member. Too apt look up to other men as though they were exalted high above him by the dignity of their various professions. Too apt to look upon his life as one of drudgery and to envy the more fashionable exterior and soft, white hands of the city clerk or attorney, forgetting the truth uttered by the greatest of poets, "There is no better sign of a brave mind than a hard hand."

Agriculture is looked upon by men of other trades and professions, as the most independent and the most honorable calling, and were all left to adopt the employment of their choice, other things being equal, scarcely any one would entirely reject the pleasures which naturally flow from the cultivation of the soil. The merchant, worn by anxiety for the safety of his investments, tried by the excitement of trade, taxed by losses or disgusted with unfeeling creditors or careless debtors, looks with envy upon the farm with its quiet, peacefulness and honest independence, and longs to fly to the sunshine and open fields for health and happiness.

The mechanic, sick of the monotony of business, the ceaseless din of the machine shop and its unwholesome atmosphere, tired of his dependence upon querulous customers or slow-paying employers, longs to become the owner of a little farm where he can become directly dependent upon his own right arm for all the necessaries of life and its many comforts.

The lawyer, disgusted with the "glorious uncertainty" of his profession and its "senseless technicalities," vexed by the obstinacy of some perverse judge or some equally obstinate jury, longs for the peaceful pleasures and honest independence of rural life.

The politician, too, has many smooth words and honeyed phrases for the farmer, especially just before an election. He can hardly contain his admiration and respect for the "hard-fisted yeomanry" and the modesty for which his class is proverbial, will only permit him to ask in return the poor privilege of using your votes and spending your money.

The clergyman, finding his efforts unavailing and that he is stirring up hatred and envy in the community instead of bringing peace and good will to his flock, can but strongly desire to doff his priestly robes and hie to the quiet country where he may find his talents better adapted to the work necessary to provide a livelihood for himself and family.

The physician, whose whole time is spent amid scenes of trouble and suffering, can but look upon the farmer with envy or wish that his life were other than it is.

But, in order for the farmer to estimate more correctly his profession, it is necessary that he should divest himself of a prejudice which was formerly very common and of which too much yet remains against what is termed book farming or scientific farming. This opposition springs from a variety of causes. We admit that much which appears in our agricultural papers and periodicals is of a trifling nature and not practical. And the man who attempts to apply what he may read to practical purposes without the aid of his reason or judgment, will meet with disappointment and failure in whatever occupation he may engage.

But, because written productions sometimes contain very erroneous views of the subject upon which they treat, is that a good reason for discarding all the important truths contained in them?

To refuse to read because error may be mingled with truth would forever close every volume. Science, that has required ages to bring it to its present state of perfection would be entirely excluded from human knowledge, because there is no branch of science that does not contain error.

Do you reject your religious, your literary or your political journal merely because mistakes or misstatements find way into their columns despite the best efforts of their conductors to prevent it? Ifyou do not, why subject the agricultural periodical alone to an ordeal that none of all the other works of man could pass unscathed? Infallibility in human productions is not to be expected, and he who refuses to investigate because liable to find errors, will make little or no advancement.

The farmer, if he would be successful in his operations, should keep up with the age in which he lives. Improvements in implements of husbandry are being made daily, and various processes described by scientific men for the enriching of the soil, etc., etc. This is a progressive age. Yet, many seem to think that the old way is the best.

These same sticklers for the old way of farming are also very tenacious of the belief that the changes or quarters of the moon exercise a controlling influence over the weather, and that certain vegetables should be sown at peculiar stages of that satellite. With solemn visage, they look at the new moon and confidently prophesy wet or dry weather. They examine their almanacs carefully, to ascertain what time to sow their peas and cucumbers, to wean their calves and kill their hogs, that the pork may swell in the pot, but when you recommend to them the perusal of some valuable scientific treatise on the subject of agriculture, they shrink from the idea with as much horror as they would to first behold the new moon over their right shoulder or start on Friday to make a journey.

The advocates of the "good old way" should be consistent, go on horseback or walk instead of patronizing those new-fangled concerns called railroads. They should shove off their old canoe and paddle along the shore instead of treading the magnificent deck of the mighty steamer. They should send their messages to friends by some traveler instead of employing the lightning telegraph. They should do as their grandfathers did in all if they insist in imitating them in farming.

Now there is no one present who will deny that there is some best way to manage a farm; and that way must be upon fixed scientific principles. Yet it is amusing to hear the different opinions of farmers whom we consider equally good, upon the most common branches of their business. One says, "Plow in the fall for spring crops; it destroys insects, pulverizes the soil, and renders it more fertile." Another says, "Not so, by plowing in the fall you expose the land to be drenched by the rain and thereby impoverish the soil." One says, "Spread the manure you put upon the land immediately and bury it deep under the furrow, that its fertilizing qualities may not evaporate." Another says, "If you do that the manure is lost, you will never hear of it again, hence it should be kept on or near the surface." One plows his land six inches deep for corn and is sure he is right, his neighbor never trusts to shallow plowing, but believes in the saying of Poor Richard, "Plow deep, while sluggards sleep; if you would have corn to sell or keep," and is backed in his opinion by his scientific physician, who, as most of you remember, at your last institute strongly advocated plowing from 12 to 14 inches deep for corn. One sows a bushel of wheat to an acre and believes more to be injurious. The man on the adjoining farm sows two bushels to the acre, and thinks by sowing less he would lose part of his crop. Many believe and strongly contend that wheat will turn to chess; others believe and say that they know it will not. One believes in a system founded almost wholly upon a rotation of crops, while another bases his system upon a judicious application of fertilizers.

Hence we see a striking need of understanding the principles of science governing all branches of agriculture. Could a uniform system be laid down that every farmer could follow with equal success there would, perhaps, be no need of this extended scientific research now advocated; but it is impossible for the wisest to establish any system of tillage which shall be applicable to all climates, seasons, soils, and situations. "But," queries one, "would you have us all be practical geologists, chemists, botanists, pomologists, physiologists, etc.?" Certainly I would, and why not? We have only to consider that all true science is but an exposition of the laws of God in nature, and that all these laws which govern the motions, affinities, and developments of mind and matter, are immutable. They are subject to no change. A law of nature is the same yesterday, to-day, and forever. The identical conditions that were essential to the development of organic life, vegetable or animal, ages past, are essential still. The same conditions that are necessary to the action of chemical affinities and compounds to-day will be necessary a thousand ages hence. Indeed, harmony, uniformity, and perpetuity characterize all the laws of nature, and these laws governing the development of vegetable and animal life, and the relations which these latter sustain to the soil, the atmosphere, and surrounding influences of whatever kind, constitute the facts of science bearing upon the pursuit of husbandry. Is it not demonstrable that he who possesses the profoundest views of the principles and philosophy of his operations is best prepared to prosecute them to a successful issue? Can ignorance be bliss or gain in such a case as this?

Now it would scarcely seem necessary to use argument to convince a thinking man that a knowledge of that science which treats of the formation of the earth can be useful to him who draws his sustenance from her bosom. We know that to drain is to intercept natural springs. This can never be done upon good principles unless the geological structure of the district be known. Again, the soil is in a measure formed by the gradual decay or crumbling of rocks. If, then, in addition to geology, we have a knowledge of mineralogy, we can tell from the rocks that underly any district what the nature of the soil may be, and for what crops it is best adapted. Botany, the science which comprehends all that relates to the vegetable kingdom, teaches the nature of plants, their mode of growth, their uses to man, or their dangers. Without some knowledge of this science we should neither know when to sow or when to reap, when to cut hay, or how to preserve it. We see plainly how advantageous such knowledge is to us, and how very valuable would be a more thorough knowledge than the farmer now possesses. Again, it would undoubtedly be considered very small business for a boy who hopes, in the bright future, to manage a large farm, if he were compelled to pass weeks and months poring over pages which treat of no larger subjects than bugs and flies, worms and insects, but these diminutive creatures are among the most powerful enemies with which the farmer has to contend. The army worm, the weevil, and the Hessian fly leave ruin and desolation in their track. Now, will not the man thoroughly acquainted with the habits of these hosts of destroyers be more likely to discover some effective means for their destruction?

It seems to me like two individuals laboring, one in the full blaze of noonday, the other in the darkness of midnight. To be sure, both labor, both plow, sow, and reap, but while the one is groping his way, half doubtingly, the victim of frequent blunders, mistakes, and failures, the other walks with firm, unhesitating tread to certain success.

Chemistry has been looked upon by some as the most important of all branches of an agricultural education. It is defined to be the science which treats of those changes in natural bodies which take place without sensible motion. Hence almost every operation which we see going on around or beneath us is in obedience to fixed laws with which it is the province of chemistry to make us acquainted. All the changes which take place from the time we deposit the seed in the ground till the grain is ready for the reaper, are chemical changes. By these the soil we till becomes the bread we eat. The stomach of every animal we fatten is a perfect chemical laboratory, in which all they eat is analyzed, and each component part applied to its proper use, one part becoming fat, another muscle, another bone, another milk, another wool, or hair. Now it needs nothing farther to convince you that the farmer can work to much better purpose with a thorough understanding of these principles.

Again a necessity for a knowledge of animals is so obvious that I need only mention the science of zoölogy, which imparts that knowledge, to convince you that it is an important branch of an agricultural education. So, too, with the science of mechanics and a moment's reflection will show you that without at least some practical knowledge of it, we could not use to advantage even so simple an instrument as a crowbar or a handspike. How much more, then, is it important to enable us to understand and manage the more complicated implements of the farm, and to protect ourselves against fraud in purchasing them. There are peddlers all over the country with all kinds of labor saving machines, which do all imaginable and unimaginable work, and which will save a fortune for every farmer who has faith enough to purchase and use them, and nothing but a knowledge of the science of mechanics will enable us to choose the valuable and reject the worthless. There are few farmers whose pockets have not been bled in this way. It has been well said that "farm implements are the right hand of agriculture and that the science of mechanics gives to that right hand its cunning."

But how, it will be asked, are farmers ever to obtain a knowledge of all these sciences. Agricultural papers are plenty and cheap. There are able and interesting lectures upon the subject of agriculture, plain, simple, divested of all technicalities and perfectly intelligible to all readers. School district libraries are within the reach of all, and if half the time spent in idle and useless talk, drinking and gossiping were assiduously devoted to the proper use of these means, the farmers of this country would be astonished at their progress.

Nor does it militate against our position, that some farmers destitute of scientific acquirements, "book learning," as it is deridingly called, and ignorant of the laws and and facts of agricultural science, are tolerably successful in the cultivation and raising of the products of the soil. This fact only proves that these men have undaunted energies, clear, strong heads, sharp and discriminating judgments, and a kind of intuitive perception of the principles of science. They know more than we may imagine. They do not clothe their thoughts in learned phrases, yet they know it, for as we have said, nothing can be accomplished in agricultural undertakings except upon unchangeable principles. He who yields to these will be successful, while he who disregards them will be unsuccessful. And again, that a man enjoying an extensive knowledge of agricultural science is no more successful than the generality of us, does not prove that science is useless. This is a hastily drawn conclusion. It merely establishes the fact that he is destitute of genuine scientific attainments, or wholly deficient in the energy of mind so necessary to the farmer.

But, in closing, it seems strange to reflect that it has ever been necessary to say one word in defense of the position taken in our paper to-day. If any man in creation needs a full knowledge of these principles, the farmer is the one. Is it not considered essential to the successful practice of the law that the practitioner devote long years of study to the acquisition of a knowledge of its facts and principles? That the politician and the statesman should possess an intimate acquaintance with the history of his country, the principles of domestic or civil economy or government, and of international law? That the physician should understand the anatomy and physiology of the human system, the pathology of diseases and the nature of medicinal or remedial agents? That the teacher should possess deep, thorough and extensive knowledge of all the facts and principles of mathematical, grammatical, geographical and other sciences of which he is the high priest and expounder? Then, why should not the agriculturist in order to secure the highest success in the practice of his profession, be deeply and thoroughly versed in the minutiae of those sciences which form the basis of his profession? Why be satisfied with the general principles which govern our pursuits? Why not dip deeply into the delightful fountain of knowledge? Even in the dollars and cents view of the matter, perfect knowledge is highest gain, aside from the pleasure and satisfaction which it brings.

How pleasant and delightful it would be to every farmer to be able to investigate and explain the whys and wherefores of all his various operations. Then we would look upon every specimen of life as replete with lessons of infinite wisdom and goodness; and, with moral nature tuned to the same exalted conception and practice of moral precepts and principles, how noble, how elevated in the scale of social, political, mental and moral gradation would the farmer appear. Then would we exclaim: Behold this specimen of a perfect farmer!

Mr. Ball: But for knowing that the writer had been a farmer I should have thought the paper a good dose of taffy, but as it is, it is the result of practical experience. No farmer any more than another can do all that is desirable, but this paper has finely indicated the sources of much that may be done.

PRACTICAL CULTURE.

BY MRS. T. B. FOX.

[Read before the Rochester Farmers' Institute.]

A truly cultured mind has a pleasing and powerful influence on all with whom it comes in contact. But our ideas are often very vague as to what constitutes true culture. Surely a few accomplishments that will enable us to pass current in fashionable society will not answer the purpose of our being.

True culture affects the heart, making its impulses kindly, reflects the "golden rule" in its influence on all its surroundings. "Whatsoever you would that men should do to you, do ye even so to them," is the very essence of all courtesy. Good manners are an outgrowth of culture, and we need not affect to despise them, for we must acknowledge their subtle charm and power.

Let us look at ourselves, at our neighbors, at society in general, and then answer, "Have we no cause to plead for practical culture?"

A few days since I read an article headed "Society Analyzed." A Georgia lady comparing the society of the "golden long ago" with that of to-day, avers that society has sadly degenerated from the high, moral, and intellectual standard to which it once attained; that the old grand manners, courtly graces, and brilliant repartee in a great measure have passed away.

It is a sad fact that society degenerates as the age advances. In the olden time girls were educated with a view to high and noble purposes, and to fill useful positions, and the boys for men of integrity and industry. Now the former are educated to make a show, and the latter to aid the exhibition. The young now enter society with but one ambition, and that is to extract the greatest amount of enjoyment from their lives. One continual round of excitement is the order, and no sooner is one festivity over before another is planned. Leisure hours are idled away or spent in getting up some wardrobe for the next place of amusement. Perhaps an air of accomplishment may be assumed, but the appetite for intellectual food is lost in the littleness of their lives.

Such young people have very little desire for the domestic circle. The parents practice the economy, the mother doing all the work, denying herself many comforts, that her daughter may often shine in new attire, thereby hoping to make a good catch for a husband, which often fails in its accomplishment, or, if successful, turns out a mutual disappointment, withering in its nature.

Few can we find to-day of the young ladies or gentlemen of so-called society who can reason, reflect, feel, or are possessed with a stock of ideas and principles ready to be applied as occasion may demand as wives, mothers, husbands, or fathers We know there are exceptions to these in every community, and grand exceptions too. Sons and daughters, who, by application, have acquired knowledge sufficient to make their influence felt in life's activities. It is not because we do not learn enough, but he

> "Who learns and learns, but acts not what he knows,
> Is one who plows and plows but never sows."

Is it possible that good talking is one of the lost arts? We believe it, for a good talker is rarely met with now-a-days. Books and papers are read: sermons, speeches and addresses are listened to by the thousand, and many of them are excellent; but an edifying talker, who can find?

Before the invention of printing, the scarcity of books made it necessary that much of the knowledge that was transmitted from one generation to another should be conveyed by conversation. And thus it happened that when persons of any information met in social intercourse, they didn't talk about the pedigree of a horse, or discuss the respective merits of two gladiators, or players, or inquire into the philosophy of some game of chance, or take up the latest scandal, or the fashions, or any of the thousand and one useless, if not degrading themes that claim so large a share of attention now-a-days. But they talked of poetry and philosophy, the economy of human life and manners, the enlargement of the mind, historical events of their own and other countries, and such subjects.

Ah! the art of conversation is not now cultivated as it was in the days of "Rare Ben Johnson," of Sydney Smith, and Charles Lamb, and others of those favorite authors who shone as brightly in the social circle as in any of their written productions. How came it to be so? They prepared themselves for company, not by dressing the body in faultless habiliments merely, but by carefully preparing the mind as well. Woe to that man or woman who at this day goes into society with garments cut in the obsolete style of a year ago. Woe to the man or woman who went into society with an empty head in that day. We look to the wardrobe for help to make us shine in company; they looked to the library.

Study is necessary to a good conversationalist, and is as much the product of sowing and cultivating as corn is. We must scour our faculties and sharpen our wits, and if we would only be content to do it, our faculties would shine and our wits cut.

The grange has done much for the farmer and the farmer's wife, to draw out thought which has been garnering up the results of experience in many nooks and obscure corners. This interchange of thought has had its awakening influence, until we look to the farmer to lead off and become the controlling force in the procession of active endeavor.

Societies for literary purposes, clubs of women and the Chautauqua circle, exist in very many localities, and have changed small villages and dull towns into centers of bright, intelligent, awakening work. They are disciplining and cultivating thousands of minds all over the country, and inspiring them with the same reaching out for a better and truer life.

These associations are often found in the most exclusive society. Jenny June says that "recently nineteen young girls, the flower of New York's finest, most exclusive and wealthiest circles, formed themselves into a modest association, for the purpose of self-culture and general development. They subjected themselves to the strict discipline of parliamentary rule; elected a chairman at each meeting, proposed questions and had debates, in which speakers were limited to time, and kept to the question by the chairman. We know there is nothing original in these methods, but the fact that they voluntarily placed themselves under parliamentary restrictions, and the character of the questions and discussions make them noteworthy. Two of the questions given for discussion were as follows: 'Is true courtesy consistent with perfect sincerity?' and 'What two qualities are most essential to the development of a noble womanhood?' Such girls are laying the foundation for future usefulness, and will perform their duty if they can find out what that duty is."

But "it is easier to train the flexible twigs than to bend the twisted wood of the matured tree into symmetry."

A lady asked her physician when she ought to begin the education of her child, then three years old, and the answer was: "Madam, you have lost two years already." It is impossible to begin too early to teach children to observe the amenities of life, and regard the rights and feelings of others. This needs the coöperation of both father and mother, for not to the mother only does the responsibility of the home training belong.

The boy or girl that is bred in the refining influences of a well ordered home, whose early mind is shaped and pruned and directed by cultured parents, starts in actual life a long way in advance of those who find themselves at maturity without any knowledge of the usages of society. Nor should the school of manners be one of hypocrisy. Seeming to be a gentleman or lady without being one, is not the question; but how best to show by deportment the natural impulses of a kindly heart, full of all that is noble and gentle.

Habits of thought and correct expression, memory strengthened, self-reliance gained, all may be acquired around the family table, with good books and periodicals, read aloud, discussed and digested, all, from the oldest to the youngest, taking part.

> "So build we up, the beings that we are,
> Thus drinking in the soul of things,
> We shall be wise perforce; and while inspired
> By choice, and conscious that the will is free,
> Unswerving shall we move as if impelled
> By strict necessity, along the path
> Of order and of good. Whate'er we see,
> Whate'er we feel by agency direct,
> Or indirect, shall tend to feed and nurse
> Our faculties; shall fix in calmer seats
> Of moral strength, and raise to loftier heights
> Of love divine, our intellectual soul."

Mr. Bartlett: I hope when anyone says that Mrs. Fox read a paper, the first question may not be, "How was she dressed?"

Mr. Peabody: I don't agree with the writer that the age is degenerating. The late war showed that our manhood is not lost, and I believe the dude boys of to-day would come to the front on such a call again. I believe we are ahead of the days of Elizabeth with her patches on her cheeks, and Beau Brummell with his hypocrisy. We dress better, more sensibly now than ever before, and I believe in the present and the future of the United States.

Mr. Adams: I remember when liquor was as free as water. It was so in my father's house. It is not so now. I don't know of such a family. I believe we are on the up grade, that there is progress every day.

Dr. Wilson: I stand here to defend the essay as read. My locks are grey. I remember society for 40 years and know how children were then reared. Parents then taught their children's dispositions. Children did not then tell their parents to go to the devil as they do now.

Mrs. Van Deusen: I don't think people worse now than formerly. The mothers of to-day are faithfully trying to elevate their children.

WHAT CAN WOMEN DO?

BY MRS. L. E. CANNON, WASHINGTON, MICH.

[Read at the Rochester Institute, Feb. 4, 1886.]

"We are but women. What can women do?"
Over and over, all a long night through,
That simple statement and the question plain
Unresting kept my scarcely conscious brain,
'Till, half awakened, half asleep, I thought
Of many deeds by noble women wrought.

"We are but women. What can women do?"
My soul made answer: "All she wishes to."
It is but true when women want more "rights"
They've naught to do but *take* them ; for all heights,
All depths, all breadths, all compass that she will,
What place so e'er she chooses she can fill.

Time was when mankind said to her, "thus far
And no whit farther. There we place a bar;
And it would be unwomanly to try
To overstep the bounds or pass them by."
But now the answer is, to all, so plain
None may repeat the words of this refrain.

"What can a woman do?" One need but ask
What's to be done? No matter what the task
Or what required. Be it courage, skill,
Patience, discretion, wisdom, strength or will,
Through every avenue she enters in.
Where women fail, men need not hope to win.

MUSIC.

BY MRS. CANNON.

Let *music* bring its soothing power
And hallowed make the twilight hour.
In times of peace or scenes of strife
How much like music is our life?
Each life is like a wondrous melody,
Or short or long ;
A wailing cry at first and then a dirge
Closes life's song.
Sometimes so long drawn out and sorrowful,
We wish no more ;
Sometimes one short, sweet, perfect strain
And life is o'er.
When hearts are young and happy hope will sing
Light on her way,
Entrancing airs caroled in silvery tone
The livelong day.
As wiser, deeper, holier thoughts arise
Grand anthems roll,
Chorus of melody in volume comes,
Thrilling the soul.
But discords spoil the harmony ere long,
A grating jar ;
Life's toil and trouble murmurs through the song,
Its beauties mar.
Then minor chords in mournful cadence wail
A low, sad strain,
In plaintive quavers softly dies away
Life's last refrain.

OUR COMMON SCHOOLS.

BY JOSHUA VANHOOSEN, PRESIDENT OF THE ROCHESTER FARMERS' INSTITUTE.

My subject is one of the most important in our social economy, and is more worthy the attention and treatment of a professor than of a common farmer. But it has a practical phase within the reach of all. From this standpoint I propose to treat it.

The organization of school districts in many rural sections, in their geographical arrangement and general management, is detrimental to the convenience, health, and educational advantage of children. Often the districts are so large as to make a distance of from one to three miles for th· children to travel, causing, in inclement weather, more or less absence, which breaks in upon the progress of pupils in their studies. In the district system, the location and building of school houses is often a bone of contention which creates animosities and bitterness which time cannot heal, and which has a depressing influence on the educational interests of all. Some, from their nature, are penurious and indifferent as to the kind of school house they will build, while others desire to build and maintain an attractive school house, and place over it a teacher morally and educationally competent to manage and instruct their children. From this cause there arises much contention and strife, a serious obstacle in the way of a prosperous and efficient school.

The same motives of penuriousness and indifference are often the dominating influences in reducing the term to a minimum which is detrimental to the interest of a minority who feel that their children should have and enjoy the advantages of longer terms of school.

We find in the report of the Superintendent of Public Instruction, that in Oakland county, in the years 1882 and '83, there were fourteen schools in which the number of pupils averaged from four to twelve. The whole number of resident pupils attending these schools was 106; an average of six months' school was taught. Each school averaged 7 8-10 scholars. In the same county there were thirty-three schools that enrolled from twelve to twenty, and in one district there were but four scholars enrolled, three of whom were non-residents. There were three months' school taught in this district at a cost of $60 for a teacher, besides the expense of school house, wood and other items. There were 217 districts that maintained schools, and they averaged a fraction over 7 8-12 months each.

These are the schools that the farmers' children have to attend, from three to nine months in the year, and many of them are taught by very poor teachers, the price being the only thing taken into account. Many more objections might be mentioned, but it is useless, for every person who has sent to the district school knows the disadvantages perfectly well.

If the district plan is to be retained, there should be some improvement made in management. In the first place, most of the towns should be redivided, making fewer districts, and placing the school houses where they would convenience the most scholars.

Our school law needs some changes. The present law allows districts to regulate the term of school according to the number of scholars, none having less than three months in the year. This is all wrong. The law should compel all districts to have at least nine months of good school. Why not? Does it make any difference how large or how small the district is? The children need the school all the same, and the law should not deprive any child of the advantage of a good school nine months in the year.

But another plan of school is recommended very highly by the superintendent of public instruction, that is the township plan. This plan is to have a graded school in the center of each town, and as many ward schools as are necessary to accommodate the small children. These schools to be governed by a board of trustees to be elected annually by the township. This has been tried in Massachusetts, Wisconsin and other States, and the superintendents of these States say that it gives better satisfaction and greater benefits than the old system. This, after a test of fifteen years in Massachusetts.

The farmers have more interest in this plan than any other part of the community, for most of the villages have graded schools, which give them great advantages over the farming community. This should not be; as every child should have the chance of attending a good graded school, whether they live in town or country. Some will say this will be more expensive, but I think that it would cost less than it does now, when you take into account the amount of money spent by some farmers in sending their children to a graded school and paying board and tuition. And this is not all, we would have our boys at home every night, under the influence of a good mother, instead of being in towns exposed to the bad influence of the saloon and other places of vice. This would be a great saving in money, and what is of more value, in keeping our boys from going to the bad. The law or custom which admits or tolerates a preference in securing an education is not in accord with our boasted equality and the bestowing upon the poor the advantages of at least an academic education. This is not all. I think it would pay as an investment, for intelligence is the basis of all wealth. You may travel the country over, and where you find the greater intelligence you will find all kinds of real estate the highest. Every good school house adds to the value of our farms. Every well educated and intelligent man or woman adds real worth to our real property. Farmers have talked long and loud about the holding of offices and places of public trust. Give us graded schools in every town as a preparatory means, then we will hear no more about the office business, for the farmer will be competent to hold any office and do his duty with honor to himself and profit to the country.

These thoughts I leave with you. If they shall do no more than stir your minds to reflection on the subject of education, I shall feel that I have added a moiety of influence in favor of a system which is at the foundation of the Nation's material, social, and political greatness.

Prest. Willits: While of course, the farmers are particularly interested in this question, it is also of moment to us at the Agricultural College, for we take the young men direct from the district school, so that the College in itself is, in one sense, a people's institution We have to educate those who shall have to do with the practical affairs of life Therefore we look to these schools as the preparatory department of the institution. Many agricultural colleges increase their numbers by including large preparatory classes which usually outnumber the regular college students. This has been urged for us, but I do not favor it nor do the Faculty or Board. The common schools are our preparatory schools and therefore I have something to say as to the quality of the preparation.

Many who apply for admission do not understand arithmetic or grammar or remember their geography or spelling. Now we do not teach these subjects. There is great need of more thoroughness in our district schools.

The paper tells of schools numbering from 4 to 12 pupils and many urge fewer schools. I doubt the wisdom of this, as it will be likely to make attendance less regular.

A good teacher with four scholars may be more useful than one with twenty. Many of the greatest men were pupils of individual teachers. Take the grandest statesmen in the world, like Gladstone and Bismark, and they have been educated by single tutors, men who have lived with them, and who have poured into them the intelligence they had; who have put into them their personality; who have directed the currents of their thought; and they have come out skilled men, skilled diplomats, skilled statesmen, and have learned how to think. They have learned how to read. Why, there is not one-half of the people of this country who know how to read any subject. I do not mean the mere reading over of the words; but to read understandingly, to get the inner sense of things, to drink in the instruction so that it may become a part of their bone and blood and spirit. Now you lose this individual instruction when you have forty or fifty scholars. The teacher has to study each individual mind and address this subject and that subject piece-meal, and the result is in a large school the personality of the teacher is spread out so that it becomes pretty thin. Now it may be true, that there are some districts which from necessity have but four or five students, but don't abolish them on that account. I have in my mind a young man right here in the adjoining county of Washtenaw, who was with me roughing and scuffling in the district school, but shortly afterwards he was taken away from us and put under a private instructor. I know it was town talk and town laugh that he had got a teacher who went out fishing and hunting with him, who lived with him and slept with him, and we all thought he was having a soft time, and so he was having a soft time, but I tell you I wish I had had the advantages and the culture he had. He has grown up to be a noble man to-day, one of the leading men of the nation in one of the largest cities of this continent. And you can trace it from this fact—he had poured into him all this skill and intelligence.

Do not fall into the idea that because your school is small you can have any kind of a teacher. A teacher who is not thoroughly prepared for work, whose views and opinions are faulty, affects the whole school. Get the best teacher you can, regardless of the cost. One reason of the non-preparation of the student is because the schools are so large that the personality of the teacher cannot reach each individual mind and hence the students go struggling along learning things half way and when they get through the arithmetic they don't know the arithmetic.

There are many sides to the question and while we see the advantages of individua training, yet we are proud of the democratic equality of our public schools. When a young man is sent into a public school it is a new life for him. Every school is a community, it has its leaders, it has its self-imposed laws which every student must adapt himself to. The moment you put him in a public school he has to fight his own way. He has got to know something of the world and he learns a fellow-sympathy with his fellow-students that is as good an education as he gets out of his books. It is the pride of our country that there is an equality of all classes. Education is free to all. The thing to do is to make education available in the meeting of life's duties. I had rather be proficient in two studies than have a smattering of many. I would rather you would be thorough with a few students than to give a superficial knowledge to many. There is such a thing as mastering a subject, and the man who feels that he is master of one thing knows that he is more of a power than the most broadly educated man who is thorough in nothing. The person who is not master of anything is loose in the sea of life without a rudder.

Mr. Pillage: President Willits says that those who are properly taught in the district schools can come from them to the Agricultural College. Do many of the students there come from the common country schools?

President Willits: About three-fourths of them. Those who come from the high schools are apt to pass a better examination in algebra than in arithmetic. So in the normal school we had to keep an arithmetic class running all the time. At Annapolis, where I have just visited, they have the same standard of admission that we have, except for our requiring a little algebra. We hear much of the aristocracy of the navy, but there at Annapolis no such thing is taught. Three or four hundred boys go together in their blouses into the shops and work for three or four hours every day, and learn to forge a chain and build a ship. But at Annapolis they find that the preparation of the common school in algebra was almost worthless, and that half of their applicants for admission come there better prepared in algebra than in arithmetic. It is not simply the question of doing a problem, but *why* do you do it ? what is the principle that underlies it? what is the principle of the greatest common divisor? There is where the thought comes,—the principal profit,—and the scholars are blind to it. They do not see the relation of things. I do not know who is to blame for this. I simply urge you to get the best of teachers, even for the smallest schools ; at any expense. Pay first-class wages and then hold your teachers responsible for the results.

Mr. Adams : Every family should be a school and if it becomes so we will have the best possible schools. Those children who are taught at home are well taught and can surpass their mates in competition. I once visited our school here. The teacher was a fine mathematician. It was his forte. I asked for his highest arithmetic class to give them a problem. There were twenty in the class. The question was this: A father says to his son I have here $10,000. If you will tell me what is the one-hundredth part of every mill of the $10,000, you may have the whole. Not one did it.

What does this mean? It means defective primary training.

Prof. Carpenter: I had seven years' experience in the schools of this county, and believe that there is as much fault on the part of the parents as of the teachers. They do not take interest enough to visit the schools. I remember a school in which a long term was taught and not a single person came to visit the school during the entire term. Now, if you don't care how your schools are run, if you simply hire a teacher and expect him to carry on your business without your applying any attention to it, it is no wonder that there are complaints of the laxness of the teacher.

The districts are already as large as they should be. They generally include a distance of three miles and some of the pupils must walk a mile and a half each way, which is a great task for the smaller ones. There are already too many of our children who come about two days out of the five in the week and consequently receive what education they get, in a very loose, rambling way. They are in a class that are continually advancing and they get two out of the five lessons a week, and as a result only skim over the subject and it is impossible for the teacher to give them that individual effort and instruction to keep them up with the rest of the class.

At the College, we have to examine many of them and we find their instruction is likely to be one-sided. They are likely to be good in arithmetic and very poor in something else. If they are very good in arithmetic, they are very poor in grammar. That, usually, is a detested study in the common schools. As a rule the girls are willing to take it up, and sometimes become proficient in it, but the boys don't want to have anything to do with it. We should have fewer studies and it should be the duty of the patrons of the district to see that their children have proper instruction in these studies.

Mr. Peabody: My education was wholly from the common schools. I wish to see them upheld. It is common to decry them in contrast with the high schools, but we cannot all afford to send our children to town to school, therefore let us sustain the common schools and take interest enough in them to visit them and aid in their work.

If we had even a poor little mangy calf way over in the field, we would go and visit that calf every day and tend it and see how it is getting along, but we have our own children go to school the whole term and not see them once. It will help the teacher and help the school to visit it, and if there is any levity going on the moral support of the visitor should be against it. Make the common school popular. If the patrons take an interest in the school, the children will, but if the patrons do not come near the school the children will think it does not amount to anything.

I know as a teacher that those scholars that were taught at home made great progress. What the president mentioned as to thoroughness in connection with arithmetic, reminds me of an incident in my life. I was at one time at Wellsburg in Canada. I was buying cattle at the time and lacked some funds and went into a bank to draw a draft on Detroit. I figured out the present worth. Gold was equal to $1.14 and of course greenbacks were worth less. The banker looked at me after I had figured the interest and said: How did you do that? and I said, "why, simply figured it," and he said: "Do you know there is not a person that comes here in this bank that could get at the present worth of money." "It seems to me," said I, "that if they ever had attended school they could do that."

Mr. Fryer: The ideas expressed in the paper are sound. It is a grand idea to have a township board of trustees,—competent men to look after matters, to carefully examine the candidates to take charge of the schools of our land. Money should not be counted in the education of our boys and girls.

The greatest trouble is deficient preparation on the part of the teachers. Arithmetic and grammar are not in the books, they are in the mind, and the teacher must understand the nature of the mind and learn to draw out and develop these powers so that the scholars may become able to think out for themselves arithmetic and grammar. We are not sufficiently interested in developing the minds of our children. We take every interest in growing a fine horse and are comparatively indifferent in human education.

The farmer must not think that for his own calling a poor quality of training is good enough. It is a wrong idea to have all the graded schools placed in the villages and towns. To be a successful and accomplished farmer requires the mind to be thoroughly trained in more lines of thought than any other profession and the occupation gives greater opportunities for the study and original investigation in the natural sciences than any other.

Rev. Roberts: Why not change our law, so as to require each district to provide eight months' school and perhaps fix a minimum teacher's salary. Students often maintain themselves by teaching farmers' children in vacation, when they themselves are wholly unfit.

Elder Donaldson: About establishing schools in the center of the towns equal to the English schools in the cities and little towns—when the rural districts rise in intelligence and education the cities and towns will rise in proportion. If you have an ignorant community in the rural districts the cities feel it, for it is from the rural districts that our strongest men in the cities have come. The feeling that nothing can be done in the way of a good education in the country and that it is necessary to go to the town or city to finish one's schooling is too well justified by the present condition of things, but if they would establish good schools in the townships, there will be a great leveling up all through the country and all through the nation. The boys and girls that have to walk a little ways or a good ways won't be hurt by it. It will help to make up a good body for the teacher to work upon.

Mr. VanHoosen: Have a graded school in the center of each township and district schools around and have all the schools of the township under one board of trustees to hire the teachers, etc., and to examine the schools and see what the studies are, just the same as in the cities. Why not? Are not we entitled to education as much as anybody? The majority of farmers' boys have to graduate from these schools.

Then further, let us carry out our laws for compulsory education and make the boys stay at school till they know something. This will cost a good deal, it is true, but what are we working for? Are we working for money, or dress, or what is it? If these farmers were educated as they ought to be, there would not be a man selling Bohemian oats in this county. (Prolonged laughter.) Now let us go right down into our pockets and have the best teachers. We have better natural advantages than Massachusetts and the New England States and we should surpass them in our educational achievements.

But while cash is needful we can also do a great deal by the use of common sense. We now support in this township eleven school districts, and in these, how is the school house located? Did you ever look at the matter? Some influential farmer has it stuck right by his own house and there is not a district but what someone has to send children two or three miles. You might have five schools properly placed, that would be less than three miles from every scholar. So you could do away with six teachers, six fires and all the other incidental expenses and build up instead a centrally located graded school that would be an honor to all of us, and we can build our own monument in that way. Now let us do it.

Elder Donaldson: As to large or small school districts, I have lived in the country most of my life and have learned that it is a great deal cheaper to send our children three or four miles to a school near home, than to send them away to school, consequently I have been in favor of doubling up our districts.

In the district where I live, the largest district in the town, the farthest the children have to go is about a mile, and those that live the farthest off, I have noticed, are the most apt to be on time. In bad weather a team is hitched up and the children brought in. In this way we can send our children three or four miles cheaper than we can support so many schools. We need fewer and better schools.

I would favor having a graded school in the center of each town. The distance does not amount to much. I sent my boy seven miles to school for five years, and he took it upon himself from choice: I told him to go until he was satisfied; he went the five years and was not tardy nor absent once, and it was a great deal cheaper to send him seven miles than to have him board there; and then, too, when he was out of school he was at home.

Mr. Reynolds: There are two things that are getting a little mixed in this discussion. The paper advocates the township trustee system. But let us not apply that to the examining of teachers. We had the township system of examination of teachers, and we had plenty of it. This is, as I understand it, a proposal to substitute for district school boards the township school board, and if that is the proposal I have nothing but hearty praise and commendation for it.

We need to centralize our school government more. It has been too much divided up into little communities, with sometimes hardly an educated person in the district to control the school. I have known a township examiner who could not write his own name. I have examined former township superintendents who could not pass an average of three on a scale of ten for an ordinary teacher's certificate. Let us not go backward in this matter. Our county superintendency system is a vast improvement over the old township superintendency system and the township board would be an equal gain over the present school district board.

I want to relate an incident or two showing the kind of teachers that we sometimes have in these little inland districts. We have heard a great deal about the high and noble calling of the teacher, and the great skill of the teacher. Of one candidate I asked the size of the lower peninsula of Michigan, and took a map and pointed from the Straits of Mackinac to the Ohio line and from Lake Huron to Lake Michigan, and asked her, "what is the size of that body of land?" She said she didn't know. "I don't know either," I said, "I don't suppose any one in this county can give it in exact miles, but I want to know your idea of the size of that land." Finally she said, after a great deal of hemming and hawing, "about fifteen miles by twenty miles." And yet I was badgered for weeks by the district board to give that girl a certificate. Another instance, of a man who had been township superintendent. One of the State questions in grammar was to compare certain words, and among others was put in the word "circular," for a catch; this ex-township superintendent said, "circle, circular, much more nearly circular." (Laughter.) Now what is the root of this difficulty? It is largely, as one gentleman has said, because we have not gone down deep enough into our pockets.

A school director was once arguing with me about teachers and I asked him:

"What are you going to pay?"

"About eighteen or twenty dollars."

"You cannot expect to get a competent teacher for any such sum as that?"

"Well, the man we want to hire would chop wood if he didn't get the school and that's all he could get at chopping wood."

Such was his idea of a school teacher!

Just so long as we have twenty-dollar teachers we shall have schools not worth attending; and I am not at all sure but that the suggestion of the gentleman on my right, that we pass a law providing for a minimum rate of wages would be a good one. You cannot get properly prepared teachers for $20 per month. The price will not create a sufficient supply of qualified teachers to meet the demand. You must hold up the hands of our county boards and encourage them to draw the lines tight. Let no worthless teachers through; let none who is not qualified receive a certificate. Do not encourage those who beg for special certificates, certificates that will be good for three months. We have had too much of that sort of thing, and the spirit of the community must back up the efforts of those who would raise the standard for teachers, even though in so doing we are raising the price of teachers.

OUR INDEBTEDNESS TO INVENTORS AND MECHANICS.

BY LEWIS M'LOUTH, PROF. OF MECHANICS, AGRICULTURAL COLLEGE.

When I speak of our indebtedness to inventors I do not mean peddlers of patent rights, or patent gates, drive wells, hay forks, washing machines, hen coops, and churns. Those venders generally get all that is due them, and often a great deal more. I mean rather those men who spend their energies in study and toil and who often suffer want in life and die in penury, but who leave the world richer by some such great labor saving device as the steam engine, the sewing machine, or the McCormick reaper. To these men and to the skilled practical mechanic whom the inventor has usually to call to his aid before his idea or his device can be perfected and brought into practical, every day use the world is under a heavy debt of gratitude. The great inventor is often a dreaming genius, and his most useful contrivances have had usually to wait for the mechanic and the practical business man, who do not dream, to perfect and bring them into general use. Fulton was not the inventor of steamboats: for steamboats had been made and Fulton himself had ridden upon them years before his practical mechanical skill and Chancellor Livingston's money made steam navigation an important part of the world's industry. Morse added not one principle or discovery to our knowledge of electricity and electro-magnetism, and yet his practical knowledge and mechanical skill, seizing upon principles already well known, gave to the world the telegraph.

It is indeed usually some practical mechanic without any genius, except the genius of industry and perseverance, who completes and brings to our notice the inventions of greater but less practical men. There is occasionally an exceptional, or perhaps, fortunate inventor, who, like Edison or Bell, has himself the practical knowledge and tact either to perfect and bring his own invention into use, or else to gather about him practical men who will do it for him, and thus enable him to reap a good share of the fruits of his own ingenuity.

Our indebtedness is, therefore, fully as much to the skillful mechanic as to the inventor, and how much this indebtedness is we can hardly conceive. All our material comforts, conveniences, and possessions are due to the inventor and mechanic, and even the leisure and strength that have enabled us to arrive at our present high intellectual status,—yes, the very refinements and the ennobling impulses that distinguish our civilization as Christian, have only been gained through the help of those mechanical devices which have so greatly relieved us from the constant drudgery and toil of getting food and shelter. The low savage that must hasten naked and shivering from his cave-home to hunt long and weary for his raw food, with stone or bludgeon for weapon, has no time nor incentive for high mental effort, and moral beauty is imperceptible to his undeveloped moral sense. Little moral or intellectual progress can be made by men who suffer daily from cold or hunger. And so the earliest inventions were those rude and simple ones that furnished primeval man the weapons and the tools that enabled him to get food, clothing, and shelter more easily and in greater abundance. The inventions that gave us luxuries, ornaments, music, pictures, books and literatures came a great while later.

Most of us, I think, realize with difficulty how much invention and mechanical skill have added to our comfort and conveniences since the beginning of what the historian would call modern times. We are mostly unaware that so common an article as a table fork, at the time Columbus discovered America, was unknown in the polite city of Paris, and that kings and queens in their palaces ate with their fingers, each helping himself like a savage from one common dish. King Henry VIII.—the Bluebeard of English history—was, about that time, the first in England to wear knit stockings. The foot covering of even the English nobility had before been of cloth. The streets of London, even a hundred years later, were unlighted at night, save by the lights in the houses; and window glass was still unknown in the houses of common people nearly to the time of the landing of the Pilgrims, and chimneys were rare even in the palaces of kings. Printing had just been invented and books were rare and costly. Clocks, such as we have, did not exist, and such as they had were so rare and costly that few large cities possessed them, and they were looked upon as a costly prize for a kingly victor to seize and carry away among his trophies of war. Flour was ground in mills but was unbolted, and a saw mill was long afterward torn down near London by an angry mob of "strikers" because it was looked upon as a new-fangled device to deprive poor men of the labor of sawing boards by hand. Popes, kings and princes rode on horseback, because it was thought disgraceful for any but ladies to ride in carriages. Sixty years after the discovery of this continent there were but three covered carriages in all the luxurious city of Paris. Even Henry XIV., the great king of France, two hundred years after Columbus's time, wrote one day to a friend: "I cannot call upon you to-day, for the queen is using the carriage." Cotton thread had just been invented, and dressing or toilet pins were about that time introduced into England as an expensive luxury,—made by hand, one at a time, and sharpened upon a grindstone. Even as late as 1812 in our own country they sold at a dollar per paper. "*Pin money*" had a meaning in those days.

In referring to these things and to the condition of things in old England in the fourteenth century a writer says: "It must be remembered that the use of artificial light for reading and study is comparatively modern. The universal lighting up of every house as soon as darkness comes over the land is a modern necessity and a modern invention. The long winter evenings of previous generations were spent by the light of a fire"—without chimney and under a hole in the roof—"not by the light of lamps or of candles, so far as the bulk of the people of all lands was concerned. But a very small number could read, and books were so scarce that kings gave security when they borrowed them, and Bibles were chained in the churches. In reviewing the mode of life of a king 500 years ago in England, we find one of the royal Plantagenets sitting on a stool whose three legs were driven into the dirt forming the floor of his bed-chamber. The queen sits on the foot of a bedstead, and as evening draws on they find themselves sleepy after a heavy supper of beef and beer. Unable to read, the time hangs heavy upon their hands." The servants who sleep in the attic above must pass through the royal bed-chamber, or climb to their sleeping places by a ladder outside. The floors of the palace are bare or carpeted with straw in which vermin breed, while there is neither a chimney nor a pane of glass to this regal mansion. Glass windows were indeed introduced into one of the king's palaces in England and into the parliament house in 1265; but country houses were not furnished with them till 1600.

But to come down nearer the present. The inventor and the mechanic in *this* century has given us the perfected steam engine,—which has furnished to every man in Christendom a third arm in addition to the two that nature gave, steam navigation in 1806, ocean navigation in 1819, and railroads about 1830.

They have given us, too, within the easy memory of many here, the telegraph, photography, the sewing machine, the reaper, the telephone and electric lighting. How beyond all estimate is the value of these things to us! How impossible, it seems almost, would it be to live without them!

But passing over apparently greater things, how much is the world indebted to the chemist and inventor for so simple and now so common a thing as the friction match? Prometheus, according to the ancient fable, was chained to a rock and tortured in punishment for stealing fire from heaven and giving it to man. Unlike Prometheus we now get our fire rather from the brimstone dominions.

The savage could only kindle a fire by rubbing two sticks together so long and so hard that they would ignite. After this came the flint, the steel and the tinder box. Towards the close of the last century chemists succeeded in making a clumsy and costly lucifer match by tipping splinters of dry wood in chlorate of potash and sugar: these on being dipped into sulphuric acid would kindle and burn. About forty-five years ago the modern friction match of phosphorous and sulphur was invented and some forty years ago they came at last into common use. Now single establishments consume annually, millions of feet of pine lumber in their manufacture, and they have become so cheap that a couple of dimes will supply a family bountifully with them for a year. How much this means many of you know who remember how we used to burn our noses and almost split our cheeks blowing a coal to light a candle, and how serious a thing it was to let the fire on the hearth go out, compelling some one of the family to run a long way to a neighbor to borrow fire. Now "give me a light," either for candles or for pipes has hardly a meaning.

We have now examined our indebtedness to the artisan, the inventor, and to the scientist—for the scientist, if not the inventor, must precede the inventor, —by studying the condition of men three to five hundred years ago, and we have taken a hasty glance at some of the great and useful inventions the present century has given to the world. Let us, for the sake of getting a little more nearly face to face with the matter, now compare the conditions of the common people, like ourselves—say the farming class of forty or fifty years ago, and right here in Michigan—with the condition of the same class of to-day. This I trust will give us a view of what we owe to mechanical skill and invention which we will all understand; and in this comparison I must be permitted to draw quite freely from my own recollections.

The farmer of forty or fifty years ago had bought his land—a forty or an eighty, or, it may be, a quarter section—of government at ten shillings per acre. It was mostly heavily timbered. Manfully he must swing the ax, and "log" and burn to clear a few acres. These acres he plowed with a clumsy cast-iron,—sometimes a wooden plow—harrowed it with an old-fashioned letter A drag, with iron or wooden teeth and a log tied across it. His team was oxen. He sowed his grain, "broadcast," by hand, or if he was an Englishman "dibbled" it in with sticks. He planted his corn by hand, cultivated it with a shovel plow and a pony, and with a hoe, and when it was ripe what he needed for meal he shelled across the edge of a shovel blade, and fed the rest on the cob to his stock and his hogs. He cut his grass with a hand scythe,—one acre being a good day's work—raked it with a hand rake, pitched it by hand with a two-tined fork, and perhaps carried it on poles to the barn or stack. He harvested his wheat and rye with a sickle, or more generally with a "turkey wing" grain cradle, and spent many a winter's day threshing it with a flail, and fanned it with the winds of March. Threshing machines without separators were coming into use, and some farmers had fanning mills.*

Then he must draw his wheat with an ox team on a clumsy, squeaking home-made wagon or cart over a corduroy road from 10 to 40 miles to market or to mill. He has a log house and a frame barn. He pitches his hay twice a year and fodders his cattle and sheep on the ground, and the only shelter they have is the bushes or the sunny side of the barn. If his hay is short or the winter long, he fells trees that his cattle may browse upon the young branches. His pigs wallow and squeal in a rail pen partly shingled with buckwheat straw. His hoes, forks, and shovels, his clevises, chains and axes are made or mended by the neighborhood blacksmith, who also irons his wagon and in winter shoes his oxen. His own feet and his wife's are shod in the brogans made by the cobbler, who sometimes traveled from house to house; the feet of his children were bare. His house of logs is floored with split puncheons or with rough oak boards, and is shingled with shakes. The single door, battened and cleated and painted brick-red outside, swings on wooden hinges, fastens with a wooden latch that has a leather string hanging hospitably on the outside, and there is a square hole in the corner of it for the convenience of the house-cat. The two windows give light through twelve pains of 7x9 glass. The single room below is kitchen, dining-room, parlor, and bed-chamber at once, or by turns. The huge chimney at one end of the house, that serves for warmth, for cooking and for light in the evening, is made of sticks, stones and mud. The cracks between the logs are chinked with split sticks and plastered with clay. His clock is a noon-mark on the floor, the setting of the sun and the crowing of the cock. His children at dark climb to bed up a ladder that leads to the loose rough boards constituting the chamber floor, and here they sleep or listen to the rain, or watch the stars that twinkle through the holes in the shake roof, while kindly nature on winter nights carpets the floors and covers their bed with a beautiful white counterpane of snow. His wife cooks all their food in the great fireplace, boiling the vegetables in a pot that hangs from a wooden crane, frying or roasting the meat in a "spider" standing among the glowing coals, and baking the bread in a "Dutch oven" or bake-kettle buried in the coals, sometimes indeed in an out-door oven or in one adjoining the fire-place, or in a tin-baker before the fire. Here was the chimney corner where the grandmother sometimes sat. It furnished warmth for the family—all the warmth there was—and blazing with split sticks at night gave illumination for social entertainments,—sometimes, indeed, there were for additional light, lard "sluts" or tallow "dips." Here our fathers read their Bibles, our mothers spun or knit the thick woolen stocking. The last thing at night was to cover up the fire, for there were no matches to rekindle it. The linen for clothing and other purposes was grown and dressed upon the farm, spun and woven by the busy housewives of the time. So, too, the woolen garments and blankets were home made, the wool was sorted and carded and spun and reeled into skeins and colored with butternut bark, and warped and woven and made up by the same busy fingers, while time was found to care for the children, go to tea parties and to church.—My good old New England great grandmother couldn't write her name, although her husband was a college graduate; and when one remembers all the long and varied tasks those fingers must be schooled to do, there is not much wonder nor much blame that they did not find time to learn the penman's art.—The old well-sweep, with its long, bent back, showed near the house and swinging upon the pendant pole hangs the famous "moss-covered bucket," that sometimes brought up a live frog or a dead toad from the stone-lined well. At the end of the house stood the great rain trough, and near by a bench, where on a summer morning ranges of tin-ware shone in the sun. Two rows of sweet pinks bordered in summer the straight foot-path that led from the door down to the bars at the road. A bush of lilac sweetened the air in spring, and in June a rose bush or an eglantine smiled with fragrant blossoms into the front window to cheer the brisk-stepping mother in her homespun and to call from her throat now and then a snatch of old-fashioned song. This was a plain, simple, laborious mode of life, but those who lived it were pleased with simple joys. They loved their homes and their God and they were ready to defend their country or their faith, and the children they bred and reared became a stalwart generation. There is a sort of halo about the picture which attracts us like a painting or a story or a song of the olden times; but none of us would be long satisfied to return to those early ways.

---

* Sir Walter Scott says that in his day, 1771-1832, many people in Scotland refused to use fanning mills, deeming it an impiety to wish for anything better to fan their grain than the winds that Providence sends.

Now let us look at the reverse picture. Those old pioneers who settled Michigan between the twenties and forties are mostly passed away, and their children and grandchildren are in their places, perhaps on the same old farm that was reclaimed from the forest by so many sturdy ax-strokes, so much of hardship and of privation.

The plowmen of to-day may ride a sulky plow, or at least turn the even furrows with improved chilled iron and steel plows that the inventor and the mechanic have provided. Jethro Tull, a Berkshire farmer of England, a hundred and eighty years ago invented a seed drill, and as a reward both he and his son after him died impoverished in a debtors' prison. With one of these drills improved and at last in common use, the farmer of to-day sows his fields. Eighteen centuries ago a grain reaper, or "header," was pushed by a harnessed ox in the grain fields on the plains of Gaul: this machine revived and improved and brought into general use by the Virginian McCormick our modern farmer rides, as an ancient hero upon his war chariot, over ten to twenty acres a day, where our grandfathers toiled slowly and wearily with sickle or grain cradle. Instead of beating out his wheat with the slow flail and winnowing it with the March winds our farmer of to-day threshes and cleans a thousand bushels in a couple of days by the aid of one of those inventions which the Scotchman, Meikle, thought out just a hundred years ago. And this machine is turned by the tireless iron arms of the steam engine, perfected and rendered practicable by James Watt scarcely more than a hundred years ago. Instead of carting his wheat to market, as of yore, over long and heavy roads, the freight car, drawn by the locomotive, which Stevenson invented sixty years ago, comes almost to his door and carries away a whole crop at a single load. The grain is ground into flour by the new patent roller process and is hurried off to the hungry mouths of Europe on one of those steam-ships which Fulton set afloat in 1806.

Instead of bending wearily while he hacks and hoes among the weeds and stones of an acre of "squaw corn" as our grandfathers did, this farmer of to-day cultivates his fifty acres with less manual labor by means of one of those horse cultivators which that same poor Tull died in prison for inventing. Instead of shelling out a little corn for meal by the aid of a fork tine and a shovel blade, he makes use of a machine given forty years ago by the inventor and the mechanic and which will do the work a hundred times as fast. He has horse barns and cattle and sheep barns through the aid of improved saw-mills and other wood-working machinery. He lives in a house whose boards are dressed and matched by machinery, whose shingles, sash, blinds, doors, casings and moldings are all machine made. The paint upon it is ground and mixed by machinery. The carpets that cover the floors and the paper that decorates the walls are made by machinery, invented since he was born. His house is warmed by stoves and furnaces, and lighted at night by lamps that a king's money could not have bought at the begining of this century. The cooking stoves and ranges of his kitchen enable his wife and daughter to do their work in half the time and with half the trouble required before Franklin and Eliphalet Nott invented and improved modern cast-iron stoves. The boots and shoes for himself and family are made by machinery and the chemist's art has given him a material for waterproof foot coverings utterly unknown to our fathers fifty years ago. Thanks to the kindly offices of the inventors of the cotton gin, the spinning frame, the power loom, the knitting machine and the sewing machine, all less and some much less than a hundred years old, he and his family are better clad than were his father and mother, while his wife rising above a menial laborer has time to learn to read and to write He and his wife may ride to market or to church in a finer spring and covered coach than the richest monarch of Europe could own two hundred years ago. Instead of covering his fire upon the stone hearth and creeping at dusk dull and tired to bed, his family at evening now gather in well lighted, well warmed and well furnished rooms, and amuse or instruct themselves with books and music, or read from the morning paper the news of the day before, gathered for him by the telegraph from every part of the habitable globe, a thing undreamed of by our fathers of forty years ago. He is better fed, better clothed, better housed, and by the aid of the inventors' labor-saving devices he is enabled to snatch from dull toil the leisure and the strength to cultivate his mind, to enlarge his understanding and to make of himself a wiser, a better and a grander man.

These, my friends, are the two contrasted pictures. These are the advantages which we of to-day have over those of but yesterday. But you say accumulated wealth has bought them. No, indeed, wealth could not buy them till the busy brain of the inventor had devised, and the cunning hand of the mechanic had made them. The very wealth that buys these comforts and luxuries the inventor himself first created and made possible.

Such, then, seems to be the debt the farmer, and we all owe to the genius of the inventor and the skill of the mechanic. It is true, there is a counter obligation. The farmer has fed the mechanic, as he has all the rest of the world; and he has furnished a large part of the raw material upon which the others have labored and on which the inventor's craft has been exerted. Cotton and wool and wheat and grass must first be grown before there is any need or possibility of cotton gins, power looms, reapers and mowers. In fact agriculture and the mechanic arts have such common and interacting interests, are so mutually helpful to each other and so mutually dpendent that one cannot thrive while the other languishes; and the effort of every wise and liberal minded man should be to cultivate and to foster both in equal degree and by every possible means.

Prest. Willits: I would like to make some remarks on the patent question. We don't need to enlarge on Prof. McLouth's paper to be fully impressed with the great benefit conferred upon our day and generation by the inventor. How has that been secured? Man invented in the past. Fancy was free in the time of Cæsar and Henry VIII. What has in this time awakened the inventive spirit? Largely, the right to the patent. When the government acknowledged that the inventor had a right to the fruit of his brain, inventive genius took a start.

If a man devotes years to the completion of a contrivance to save the labor of men, it is right that he should have property in this contrivance. If I give you an idea to-night you may go out and use it, because these ideas are not copyrighted; but Congress, in order to foster invention, established the patent right system, and in consequence we have this harvest of invention.

At Hudsonville, members thought the patent law had become a nuisance, and should be abolished. There are certainly evils in it and these should be looked into. When first in Congress, I was put on the Committee on Patents, and took up the subject to investigate it, and was charmed with the men with whom this threw me in contact—with the patent lawyers—men who add to the usual legal requirements, special mechanical skill. In their library I saw the records of the patents of the nation. Often, now, the inventor loses, because it takes money to secure the patent and put the patented article on the market. A patent is an exclusive right for a limited time, to use, sell, and make the invention; after which time it becomes the property of the whole world. Out of 300,000 patents probably not 5,000 have paid the inventor—all the rest have been a loss to the inventor. A patent to be valid must be *new*, never known before, not even one thousand years ago.

An inventor makes his application and the examiners look through 300,000 patents to see if this has been previously patented in the United States. They have copies of hundreds of thousands of foreign patents, which must also be examined. Not only that, but from whatever source the evidence comes, if it appears that the principle has *ever been known* the claim is not valid, and so the examiner searches through cyclopædias, newspapers, etc., etc., and if the claim seems to be novel, the applicant gets his patent. Let the examiner be as honest as may be, he may miss some previous knewledge, and so, after the patentee begins to manufacture, others making the same thing, institute suit to show that the patent is invalid. Sometimes many contests are made over the same thing. Often it is the most trifling patent which brings the best returns. I remember one case. I have just been in a hardware store and got a tin spoon of which the price was one cent. It is cut from a straight, flat piece of tin. That feature is not patented, but the handle is creased. That crease strengthens the handle five-fold, and is patented, and the patentee wanted his patent extended after he had received $125,000 and spent $50,000 fighting an infringement, thus clearing $75,000. I thought he had made enough and reported against its extension. Nearly everything has been patented. They tell us of our being taxed from the cradle to the grave. We are certainly covered by patents from the cradle to the grave. I concede that there are some evils that should be remedied, but this does not prove that the system should be wiped out. I would ask if any one ever came to grief by buying at regular stores?

Prof. Beal: In Lansing, harrows were sold that were infringments of patents.

Prest. Willits: Well, that is one case. But in general it is the perambulating agent that gets you into trouble, and I dare venture that other swindlers have hurt you as much as all the patent right swindlers. For instance the Bohemian oat men.

I remember one patent case, the clover huller, for which, as member of the committee on patents, I was asked to extend the patent, when at that time there were, in my district, thirteen suits, and in Michigan seventy-nine suits for infringment. Each purchaser had a guarantee against the rightful patent. They were induced by the oily tongue to buy and thereby bought a lawsuit.

The proposition is made to hold the consumer harmless, but the constitution seems to be in the way, as that instrument makes a patent right as much property as a horse. If a man steals your horse and sells it to an innocent purchaser you won't hesitate to take your horse. You can't, under the United States constitution, take away this right to sue the consumer.

But there is a way out. The government can say how you can sue, and say that if one sues he can recover no costs if awarded less than $20 damages. So if you have a patent gate worth only $5, it will not pay to sue the user, but only the seller.

THE AGRICULTURAL COLLEGE.

INSTITUTE TALKS BY PRESIDENT EDWIN WILLITS.

It was the intention not to have me on the programme, as I desired to come as a learner, to find out the wants of the various localities to which we go. In these institutes it is necessary to suit our choice of subjects to the needs of the sections where they are held. Thus if you had no swamps in your county, the paper on the drainage of muck swamps would have been of no interest to you.

It is our object to find out the problems that are in your way in order that the College may address itself intelligently to their solution.

I have been the last six weeks in Washington to help secure the passage of a bill for the support of experiment stations. We spoke before the congressional committee of sixteen members, and found that the members from New Jersey and from Kansas had very different ideas as to what might be the use of experimentation because of the different needs of their localities. We wish to discover in what ways we can experiment for your benefit, and thus find how we can be of greatest value; for the success of this College depends upon our knowledge of the needs of the various localities of the State, and this we can get in these institutes.

I find that all through the United States the people are longing for scientific facts, for the aid of science in the problems of agriculture. It is not only that the people are being instructed by colleges, but that they themselves are discussing these questions, and such discussions will stimulate thought and develop knowledge. It means a change in the character of the people. Farmers are not looking to others so much as to themselves to elevate their calling.

The old adage says, "Man made the town but God made the country," and it is the country that replenishes and builds up the life of the city. The blood of the country vivifies the arteries of trade and learning. There is a constant movement from the meadow to the city. The country makes the man. Hitherto it has been the city chiefly which has developed the culture of the gentleman. Men march and fight better when their elbows touch. A neighbor is good because you may light your soul from his. So the city and country may supplement each other.

The country boys have been going to the city, and while some have succeeded many have failed, and now the country says, we will develop a culture ourselves; we will draw ourselves together and work shoulder to shoulder in the cause.

So in our colleges we find that the best of their material is from the country. Princeton, the alma mater of so many great men, has drawn its best blood from the country and from the west.

All honor to the boy who has the grit and the will to cultivate himself alone by the firelight; but where he can take it, give him the opportunities of college work. It is best to educate the boy with his fellows. Attrition sharpens the mind. The country blood means business, there is no taint of swill-milk in it. It takes attraction to keep a boy on the farm: take him into your confidence: show profit and loss: and that it is a science and not mere drudgery. Make your boys your companions and work with them in their desire for development and they will not want to leave the farm.

So in your institutes and grange meetings you meet together and develop one another and work out that culture for which we used to look to the city, and which will make the farmer able to represent himself and his class. The time will come when it will not be said by anyone that a farmer can not go to congress or sit in our legislative halls.

* * * * * * * *

Of this small globe it is estimated that one-fifth is under cultivation. For 6,000 years the human race has worked on its surface, drawn its sustenance from the forces of nature, and to-day there is less arable soil on the globe than at first. We say man has improved on nature. True, he took the wild apple and made the greening, and all of our improved grains and breeds of animals from their original wild types, yet, notwithstanding, in large regions man's step has been a blight to the earth. Ruins of palaces and temples standing in the deserts of Palestine and of Palmyra, of Spain and North Africa mark the devastation wrought by man. How has this desolation been brought about? By unscientific farming.

But we need not go to the old world for such illustrations. We have occupied this land less than 200 years, and yet there is a territory equal to that of France which, once fertile, is now exhausted. All through the south are worn out, abandoned farms, eloquent testimonials to the evils of unscientific agriculture. About Washington, where once was perfect garden land, you may ride for miles without seeing a comfortable farm. The valley of the Potomac, once the garden of Virginia, is now a wilderness in contrast with which the view which greets you on entering northern Ohio is a perfect feast to the eyes. Not only have these fields been abandoned, but they seem to have had the heart taken out of them. A gentleman told me he had bought very cheaply twenty miles from Washington, a fine-looking clay farm. He tile-drained and plowed and tried to seed to clover, but clover would not stick and he found he could not raise wheat without fertilizers. He tried to put it down to grass, but grass would not take.

The old Virginians not only depleted their soil by raising tobacco, but they raised slaves and sold them off from the land. It has been estimated that it costs $1,000 to raise an adult human being, and all of that value has been steadily abstracted from old Virginia's soil with no equivalent return, and now she is left in her desolation.

Where has gone the value of the New England farms? It takes value to raise men, and those farms have raised men. It takes the whole substance of an acre of good land and the labor of cultivating it to make a man, and when he goes west he takes the good of that acre with him. You remember the traditional fertility of the Genesee Valley, and yet you have seen Central New York lose its hold as a wheat country. What did they do to restore it? They put in clover and did restore it for a time, but now it is getting clover sick, and now what?

Here in Michigan we are encountering the same problems, but scientific agriculture is coming to the rescue and building up our farms. Parts of New Jersey twenty years ago wouldn't raise wheat or white beans; now they raise all crops. They have learned how to take care of their land.

In 1844, Liebig issued his work on Agricultural Chemistry, and in twenty years from that time Germany had fifty-five institutions like our Agricultural College, and not only was this growing sterility stopped, but Germany now raises twice as much wheat per acre as before Liebig's work was written. Germany raised beets. The crop began to fail. Scientific agriculture told what remedy to apply and to-day they raise beets as well as ever.

It is such results that follow from the so-called impracticable work that is done in the Agricultural Colleges. It may be said that there is but little chance for scientific agriculture in clearing land or in working among stumps, but man's work is in improving what he finds and if he attempts this unintelligently he may do more harm than good. May he not in draining do more harm by killing the native timber than he does good by the drainage? There are now vast areas of Michigan that are valuable only for their timber and we must, for that part of the State, study the problem whether when stripped of their timber such lands may in any way be made of agricultural value.

Scientific agriculture is no mere phrase. On virgin soils with their full original strength it may do to scoff at scientific agriculture, but the time comes when this original capital is spent. If you take twenty-five bushels of wheat from your land, do you leave it as good as it was? What do we now with the products of our land? We put them into our sewers, and, lest they should by any chance get back to the land, we flush these sewers and flood them all into the sea.

* * * * * * * *

In 1882, when it was determined that my usefulness in Congress had been impaired so that it was not expedient to return me, I came home with the full purpose of re-entering upon the work of my profession, when much to my surprise, I was invited by the Board of Education to take charge of the Normal School, and I finally concluded to do so and was much gratified by the cordial endorsement which my appointment received. Once in the work, I became absorbed and interested, and giving up my law partnership, devoted myself to the cause of education. But I had hardly more than begun to see the fruits of my new undertaking, when, a year ago last September I met a gentleman in Detroit, a member of the State Board of Agriculture, who proposed to me that I should become the President of the Agricultural College. This was again a new thing to me and I looked through the literature of the subject and found that the Michigan Agricultural College stood head and shoulders above any other school of the kind in the land. The more I looked into the matter the more the idea grew upon me and I finally consented to accept the position and began my work last July. At my first visit, Dr. Beal asked me what kind of cattle I liked best. I said I didn't know. Said Beal, isn't it a little funny for a President of the Agricultural College to know nothing about cattle? I said I should pretend to know nothing which I did not know, but that I did not believe it was essential that I should know all these details in order to be a capable head of the institution. My work is to be a captain to these lieutenants and see that they have opportunities to work, and I shall make it my business to see that the Legislature is not left in the dark as to the character of the work that is being done there.

* * * * * * * *

The Agricultural College is not a thing of American invention. The idea, like our improved cattle, was imported from across the water.

Why, Austria maintains 60 day and 174 night Colleges of Agriculture. Prussia has more than 200, and in addition has scores and scores of experimental stations.

Even little Sweden expends more than two millions of dollars per year for Agricultural Colleges.

The French budget for 1885 included $10,000,000 for the advancement of Agricultural science, and of this sum $200,000 was for the one branch of it —Veterinary science.

What is the result?

In the whole French republic there is not a foot of unproductive arable soil. Instead of deteriorating it is improving. We have to send to Paris to get our horsikin to teach Veterinary anatomy. Why not make these things here? Because they are ahead of us in Veterinary science and so we have to get our Veterinary tools from Europe. Apart from colleges, there are 74 experimental stations in Europe; Italy, smaller than California, has 13 experimental stations and 33 agricultural colleges.

Do you wonder that they can make improvements and peddle them over here?

I speak thus because many think much money has been spent on this College. But I can tell you that but for it you would have less money value in your State to-day.

Michigan, when she founded her common school system, founded broad and deep, and stands to-day in educational matters the peer of any State. She was the first State to see that an agricultural college should be an institution by itself. You remember the fight that was made to attach the Agricultural College to the University. But those who advocated that plan forgot one thing.

While it is true that we teach many of the same things that are taught at the University, yet we teach them differently. Our illustrations and applications are all different. Dr. Kedzie teaches chemistry the same as Prof. Prescott, but his application is largely agricultural.

I found that the agricultural colleges which had been kept separate were prosperous and that where the United States' land grant had been given to a university the agricultural addition, as far as attendance was concerned, was a failure. Take for instance Cornell University, the principal part of whose endowment is from the United States Land Grant for the advancement of agricultural education. Of this grant they have already sold lands amounting to

$1,500,000, and they told me that they had still unsold pine lands in Wisconsin for which they had refused $800,000. When they had told me this I asked to see their agricultural department. With this $2,500,000 endowment they had but 14 students in agriculture.

The Michigan College was from the first an independent and purely agricultural school. It was first opened to students in 1857 and from that time till now has steadily grown in reputation and influence. It has a farm of 676 acres, of which 100 acres is a beautiful park in which the various College buildings are located. It is situated three miles east of Lansing.

In 1862, Congress saw that we were drifting into sterility and that science was needed to restore our land and donated some of the good lands to endow colleges of which the leading purpose should be Agricultural instruction, not experimentation. The act gave to each of the States 30,000 acres for each Senator and Representative in Congress, by which Michigan received 240,000 acres of land, and the whole of this was at once given by the State to her already existing State Agricultural College. One-half of this has been sold and the proceeds are held in trust by the State, which gives 7 per cent. interest on the same. This gives us $30,000 per year, and enables us to give tuition free and rooms at the cost of heating; privileges which at Princeton cost the students $150 each per year. This endowment was primarily educational in its intent. It did not provide for experimentation. But all along, public sentiment has demanded experimentation and thus it has been introduced as a secondary thing with what has been left over from instruction. Now we wish from Congress a supplementary endowment for agricultural experimentation, which would give $15,000 a year to each of thirty-eight experimental stations in the several States.

In Louisiana the burden of this experimentation would be about the production of sugar and cotton, and in each State the work would be devoted to the specialties of that State.

Everywhere the advanced agriculturists are interested in this matter and they are looking to our College as a leader in the work and they seek our counsel and copy our example.

Experimentation that is of decisive value is a slow and costly thing. Dr. Kedzie's experiments upon which his article on Nitrogen is based, ran through four years. In England, Messrs. Lawes and Gilbert have been working twenty-eight years to test the effect of manures.

Then, too, after an experiment has been made the probability is ten to one whether its results are of great value; but when we do get one that succeeds that one is worth more than the cost of all. Was it not so in Germany?

It is our duty thus to build up our country. Michigan has done well, has made a good beginning, and has a grand college at Lansing. I say this not because I am connected with it, for I examined it carefully before embarking my reputation with it and I thoroughly believe in it. I believe that there is a constituency of young men in this State who want to be not lawyers nor doctors, but farmers or mechanics, and that if the Legislature will stand by us we can have five hundred students in five years and be ahead of anything of the kind on the continent. The past year we put up $25,000 worth of new buildings with money given us by the State Legislature, because by the terms of our grant from the United States we are prohibited from using any of our interest money for that purpose. Now we want your boys. I am gunning for boys. When I went to Lansing, I found the attendance running low and I determined if possible to increase the number of students. We have a plant costing nearly $400,000. We have most complete facilities. Our departments for instruction in the natural sciences excite the admiration of all comers. Our work is chiefly of *applied* science. Prof. Johnson talks of agriculture in the class room and carries it out on the farm.

Prof. Bailey teaches landscape gardening in the class room and then discusses the effect upon the landscape of the removal or planting of particular trees. He teaches grafting by having the boys do it. We have a greenhouse with many thousand plants, a botanical garden well stocked with native specimens, and a laboratory second to none in the country for botanical study. Last term we had two special students in botany all the way from Japan. Dr. Beal had them working with microscope and samples of corn smut and so on for seven hours a day.

In chemistry, we have a special building, with lecture room for one hundred and fifty students and laboratory where the boys practice analysis.

* * * * * * * *

In veterinary science, the Legislature gave us money to set us up, and we take a horse to pieces as they take a man to pieces at Ann Arbor. I want to talk a little about this subject of veterinary.

Dr. McCosh, President of Princeton, laughingly said of President White, of Cornell, that he had imported from Europe a philosopher and a horse doctor. President White retorted that he had secured the two professional gentlemen referred to, but of the two, the so-called horse doctor was the more valuable.

I made it one of the conditions of my acceptance of the presidency of the Agriculture College that the State should place veterinary science on an independent basis at the college.

When in Washington I was greatly impressed by the magnitude of the animal industry of the country and the prevalence of diseases and the ignorance as to remedies. Brutes cannot tell their symptoms and yet we have got through the ages with the merest quacks in animal medicine, and so I thought that Michigan ought to stir in this matter and see to it that training in veterinary science was developed. Last fall, Missouri lost $100,000 in less than a month's time from pleuro-pneumonia.

Belgium has a veterinary college which receives $30,000 per year and treats 7,000 animals gratuitously each year.

Even the Netherlands give $30,000 a year to a veterinary college—as much as the running expenses of our entire college.

France, with an area but four times that of Michigan, spent last year $200,000 for veterinary science besides $100,000 for paying for animals killed to prevent the spread of contagion.

Finally, as a matter of instruction, we have our farm. Perhaps some critic sneers and says there is no great farming, that our wheat costs us $25 a bushel. I do not know the method of estimating adopted by such critics, but the cost of our institution is the cost of instruction and it is not a question of what it costs to raise a bushel of wheat.

We pay our boys for their work 8 cents an hour, and they are able by that means and by winter teaching to do much toward supporting themselves.

There are two principal points about the institution:

1. It is a place of applied science.
2. It is place of honest labor, where the sentiment is in favor of working with the hands.

This is the best feature about the institution.

In most of our colleges and high schools our boys think they know more than their fathers, and are sure that they know more than their mothers. They get on stand-up collars and construct poetry and think farming contemptible. Our college takes a boy and he is not ashamed of a good, honest day's labor. We haven't a dude in the college. When our boys come they are sometimes thin-blooded and round-shouldered, and we put them at work in the military and teach them to get into line, stand up straight and look you in the eye.

* * * * * * * *

Some say that we ought to carry the boys farther, and as a necessary condition to this have higher terms of admission, but we think differently. It is a great point in favor of our college that we do receive the graduate of the country district schools.

Samuel Johnson, the English author, said: "You can make something of a Scotchman if you catch him young." So we want to catch the boys young. Our theory is that Michigan's common schools should be a sufficient preparatory department for our college, and we say if you have a thorough knowledge of geography, grammar and arithmetic, reading, writing and spelling, come along and we will go with you the rest of the way.

* * * * * * * *

They say we don't make farmers. It is not true! More than 50 per cent of our boys have become farmers; a larger per cent than the law schools make lawyers.

When in Washington working up the experiment station question, I went into the library of the bureau of education and in the department where the foreign books were. There was a lady there who spoke all those foreign languages and she spoke to me of the foreign experiment stations and of ours at home, and she said to me: "You know the Michigan Agricultural College is at the head; it is the best." I said, "Yes, I know that, for I am the president of it." She was taken back, but I would not spoil the story for relationship sake. I believe in this college, and that the people of the State of Michigan will continue to foster it.

LIGHT SOILS.

[This discussion was by accident omitted from the paper which called it up.]

Prest. Willits: The paper suggests that soil may be so poor that it will not take clover. In such a case some outside manure would be necessary as a starter. There are two kinds of sandy soil in this State. In Monroe county the sandy soils will grow clover of themselves. Most of them had water close to the surface, but by means of open ditches this water level was lowered enough to admit of cultivation Germans took up these lands and by manuring and clovering have brought them to a high state of fertility. But there were tracts of what they called quicksand that seemed like an open grave for all manures. You might, by manuring, raise a single crop but no more. Now we have in the northern part of this State large tracts of very light soils, and it is a question whether they can ever be made good for anything or not. We have 30,000 acres of the land on our own grant and on these are many abandoned farms which were taken up by settlers who were not able to make them profitable, but after the first crop or two had to give up the job. Now the question is whether special kinds of grasses and ways of applying them may not be found by which even these lands may be brought up. Grass is the great natural restorer of the soil.

I knew a northern gentleman who bought a fine farm near the city of Washington. He tried commercial fertilizers on it, but the land had so thoroughly lost its heart that they would not pay their cost. He tried sheep, but they seemed to sympathize with the land and died of foot rot. It is probable that those worn out Virginia soils will have to lie for long years for the gradual restorative processes of nature to take effect.

Now we have various soils and we must learn how to deal most advantageously with each one. In Monroe county we found that plaster did us no good, while west of us it was of the greatest benefit.

Mr. Estabrook: As to men abandoning lands, perhaps it is land from which they have stripped off timber.

Prest. Willits: Thanks for the suggestion. Peter Henderson tells of a Long Island garden that had been run and run till it was almost impossible to rent it. Then a German came along, when it was almost worthless, and rented it for ten years with privilege of purchase at any time, and in five years he had bought it with what he raised. He said to Mr. Henderson he only wanted the soil to hold the plant while he fed it This was sand on sand. Happily for Michigan, perhaps, the Agricultural College has got stuck with a lot of this soil and we shall experiment with it, if we can get the money, and try to learn what this German taught Henderson.

Mr. Lewis: Let me tell of a real estate agent who went up north with fertilizers, grew enough in a wet season to sell some land, but in dry season the wind blew away soil, crop and fertilizers.

* * * * * * * *

Prest. Willits: I wish to ask a question. It is well for Mr. Stark to advise us to buy clay farms, but we can't all get them. Probably a majority of our soils are light and many owners of light soils would not swap for heavy, so we may hope to settle the whole State. But the point is that there is a difference in light soils. Now what makes this difference? Sand is sand. It is flint. It is not nourishing. Now why is one sand inherently better or worse than others.

Some sand holds manure well and of some sections it is said they will produce two or three crops and then give out. *e. g.* Up north in the Flint and Pere Marquette region are hundreds and thousands of acres that are of this character and there we find comfortable farms abandoned. Even in beech and maple lands near Ludington we find the same thing. This is a live question. We know what to do with clay. We know what to do with good sand, but do we know what to do with these light sands? Is the failure owing to bad tillage? Is there a way to make them valuable?

AGRICULTURAL COLLEGE BULLETINS.

No 17.—ZOÖLOGICAL DEPARTMENT.

THE CARPET BEETLE.

Every year brings its new insect pests to annoy, and too often to thwart the plans of our farmers and fruit growers. Generally the most to be dreaded of these foes are imported species. Insects, if we may judge by their work, do not need acclimatization, but the rather a change of air and climate, as we always note that it is the new comer, the fresh importation, that flourishes best, and works most mischief. The latest immigrant to reach Michigan, and one of the latest in the United States, is the carpet beetle, Anthrenus scrophulariæ. This is not only a new comer and a foreigner, but, true to its class, it is a most terrible pest, as will be fully shown in the sequel.

There is another most discouraging feature about this carpet beetle; it does not work like most injurious insects in field or garden, directly injuring only the farmer, gardener, or fruit grower, but it comes into the houses in city and country alike, and lays tribute upon every one who possesses a carpet, rug, or any woolen apparel or other woolen goods. Even the finest Brussels of the city palace no less than the beautiful rag carpet of the cozy farm house, may be cut and ruined by these diminutive beetles.

HISTORY IN THE UNITED STATES.

This beetle has long been known in Europe, and has frequently been found there on flowers. It is not reported, however, to feed upon carpets or woolen fabrics in Europe, but has been known to attack meats. In 1874 there were numerous reports of great injury to carpets, etc., in New York and other eastern and New England States. In 1876 Prof. J. A. Lintner wrote a full and admirable description of this beetle, which was illustrated by excellent figures drawn by Dr. C. V. Riley, which figures are used in this article. Since then these minute insects have rapidly spread, and have brought consternation wherever they have gained a foothold. Two years ago I received specimens from Lenawee county; while this year I have specimens from several widely separated localities in our State, and from several other States. In every case there comes a wail of discouragement, and an urgent appeal for help.

NEED OF INFORMATION.

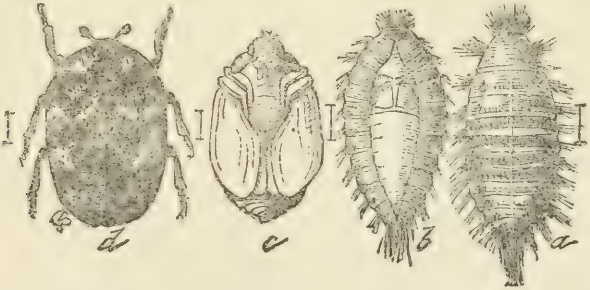
There seems to be almost no knowledge of this insect even by those who have suffered the most deeply. One person whose carpet had been ruinously slitted even across whole breadths, sent with these larval carpet beetles specimens of the common clothes moth, large cut worm moths, and several other insects which he had found in and about his house, and asked which was the real culprit. Another who had had a beautiful and costly shawl cut in twain as by a pair of scissors, sent the insects in all stages, but supposed, contrary to the fact, that the beetles and not the larvæ were the transgressors. Others are entirely ignorant of the cause of the damage.

WHAT IS IT?

This enemy is a beetle, and should be known as "The Carpet Beetle." It is often, though very improperly, called the "Buffalo Carpet Moth." The first part of this name, said to be given it because of its hairy appearance reminding one of a buffalo, and not from the city of Buffalo, is entirely unnecessary and may well be dropped, while the fact that this is a beetle and no moth at all, should surely relegate the last part of the name to oblivion. Carpet beetle tells the whole story and the truth, and so let this be its name.

This beetle belongs to the family Dermestidæ, and is closely related to Dermestes lardarius, the bacon beetle, which thrives upon dried insects, and other museum specimens, as well as most kinds of animal tissue. This last insect is often a great nuisance in museums. I also find it frequently about the combs in the apiary, where it feeds upon the dead bees and perhaps on pollen. The carpet beetle is still more closely related to the Anthrenus varius, which has similar habits to the Dermestes lardarius, and is even more to be dreaded, as its small size makes it more difficult to fence against it, and renders it more likely to escape detection when it is working its mischief.

A. varius, like *A. scrophulariæ*, is often seen on flowers when the insect is in the mature state.



Carpet Beetle much magnified, small lines show real size. *a*, *b*, larvae, *c*, pupa, *d*, beetle.

THE CARPET BEETLE DESCRIBED.

The minute, but handsome beetle, d. in Fig., is only one-eighth of an inch long, and about two-thirds as broad as long. The main color is black, while a dorsal red line extends longitudinally, bordering each wing-cover internally, and is marked by three projections on each wing-cover. Opposite these red projections on the outside of each wing-cover are three white spots. This handsome little pest will be found in concealed places from October till the following spring. As the beetle does not eat, no harm will be done by the insect while in this stage, except as in egg-laying it prepares for future mischief.

The larva—the real mischief maker—(*a* in Fig.) as will be seen is about one-half longer than the beetle. It is ringed with light and darker brown bands, and the body is margined with tufts of brown hairs. These are very long at the ends of the body, and at the front end obscure the head. Similar shorter hairs clothe the whole body. The ringed and hairy character makes it easy to identify this larva.

When the larva is fully developed, usually late in July and August, it seeks some concealed place, as the crevice between the boards of the floor, where it changes to a pupa (*c* in Fig.). Sometime before the full change to the pupa is made, the larva skin breaks open as seen at *b* in Fig. Usually the pupa remains in this split skin, though many sent to me in boxes had fallen out. These pupæ, which will be seen from July to October, and even later, are quiet, and so of course do no damage while in this state.

We see, then, that the injury from the carpet beetle comes through the larva and is most marked in June, July and August, when the larvæ are most numerous and abundant. The fact, however, that beetles are emerging from the pupa state from October till the following spring, together with the artificial conditions of heated rooms will, undoubtedly, as has been the case with the clothes and carpet moths, vary their habits in this respect, so that very likely in our rooms that are always kept warm, development may be hastened and the insect may become even double brooded, so that quite possibly we may find the larvæ feeding at all seasons. Another fact may change these cycles of growth and development, that is retarded development of the larvæ. I received in August, 1884, one of these larva and put it into a close wooden box with a small piece of woolen cloth, and it did not become a pupa till the next August. It is possible that the food was not to its taste, and so it fasted, and was slow in coming to maturity. I think, then, that while we may expect the most injury in mid summer, we may well fear that in warm rooms, at no month of the year will our woolen goods be entirely out of danger, if we harbor these pernicious beetles in our houses.

REMEDIES.

The fact of the rapid increase of these insects, and the terrible destructiveness which attends an onslaught by them, makes it imperative that we find a remedy for this evil or else abandon the luxury of carpets, not to speak of woolen garments. Cases are known where the insects have taken entire possession of houses from basement to garret, in the year or two's absence of the owner, and have destroyed or seriously injured all woolen belongings, even to the picture cords. The small size, fearful destructiveness, and its power to resist insecticides makes it a terrible pest. And wisdom urges, that all learn to detect it so as to stamp it out upon its first arrival.

Experience shows that it first attacks carpets, and there is where we may look for an assault. Like the well-known carpet moth, *Tinea tapetzella,* it works first and most at the borders of the carpet. Though I have had no experience in battling these pests, yet from my general knowledge of such matters, I think I may urge certain remedies with much confidence.

First, I should recommend ironing wet cloths placed over the affected part of the carpet, using flat irons that are very hot. The cloths may be two or three thicknesses of common toweling, wrung out of water just so

29

they will not drip, then ironed till dry. To secure the best results one ought to have a dozen or more irons. I have found that this thoroughly done is most deadly to the carpet moth larva, and surely the intensely heated steam penetrating every fiber of the carpet, and to every crevice of the floor, must sound the knell of every larval carpet beetle that feels its deadly presence. I have tried this on delicately tinted carpets, and while it was delightfully efficient in destroying insects, it did no injury whatever to the carpet. The only caution here then is to make thorough work; *be sure of a full head of steam.*

Another remedy of which I should feel quite certain would be to brush, by use of a paint brush, the floor under the carpet with a strong solution of corosive sublimate, the bi-chloride of mercury. This should be made as follows: Four parts (by weight) bi-chloride of mercury, one of chloride of ammonia (sal ammoniac), and fifty parts of water. This is surely fatal to bed-bugs, *Cimex lectularius*, and certainly these carpet beetles can hardly be possessed of more lives than are the bed-bugs. The objection to this remedy is the virulency of the poison. Of course with care there is no danger; but so many of us are by nature and practice so culpably careless that to have such a poison in the house is hardly safe.

I have reason to believe that tarred paper under the carpets, napthaline, the crystals of naptha, kerosene oil or gasoline would each and all kill the insects if freely used under the carpets. There are two objections to their use. They are all more or less offensive as to odor, while the last two from their inflammable nature might do great harm. I have used the napthaline with marked effect. And although it does scent a room thoroughly it could be removed after effecting a cure, and the carpet and room so aired as to greatly lessen this objection. Kerosene would surely kill all insects that it touched, but its tendency to stain the carpet, and its persistent odor might be considered serious objections to its use. Gasoline—much better than naptha, as it never stains and quickly evaporates—is also a sure cure, and great caution to thoroughly ventilate before any fire is brought near would render its use safe. If used thoroughly in any case, no fire should be allowed even in a distant room till thorough ventilation, as shown by the absence of the characteristic odor, had removed all the explosive vapor. As an accident by the use of gasoline might be most terrible it should only be used with the greatest care.

In case furniture is infested, the free use of gasoline would be the safest and surest remedy. In this case, the articles to be treated could be removed to an outbuilding, and should not be returned to the house till the liquid had thoroughly evaporated.

Woolen garments not in use may be protected by putting them in perfectly close boxes. As the insects are so small, we could not be sure that they were excluded except that we paste paper over any crack, as where the cover meets a box or trunk.

In such close quarters, camphor gum, which keeps clothes moths away, is said to make no impress upon these beetles. I believe napthaline, which I am told not only keeps the Dermestes lardarius away but actually destroys it when once at work, would also serve to protect against the carpet beetle. The trouble with this would be the persistent odor. Yet it is possible that if it should be closely wrapped in a cloth it would still keep the beetles out, and yet would not so scent the clothing that it would not soon pass off upon exposure.

If clothing should become infected it could be put into a close box and drenched with gasoline. As soon as the insects were killed the clothing could be aired, when the odorous liquid would quickly escape. Bisulphide of carbon could be used in the same way. This is deadly to all insect life; but it is fully as explosive and dangerous when fired as is gasoline. So if it is used we cannot be too cautious.

A. J. COOK,
Professor of Zoölogy and Entomology.

AGRICULTURAL COLLEGE,
September 3, 1886.

No. 18.—FARM DEPARTMENT.

WHEAT.—NOTES ON VARIETIES GROWN ON COLLEGE FARM, '85 AND '86.

This bulletin is issued to give such facts in regard to the yield, hardiness, and habits of growth of several varieties of wheat which have been grown on the College farm the present season, as may be of general interest to the wheat growers of our State.

Field No. 8 in the regular rotation was sown with four varieties of wheat.

Clawson.

Eight acres of Clawson. Seed sown, 12½ bu. Sown Sept. 18, cut July 15. Yield, 151½ bu., 18¾ bu. per acre.

The soil of this field is mainly a rather stiff clay loam; but a portion of the field where the Clawson was sown was a reclaimed tamarack swamp. The wheat on this portion of the field (a mucky soil) seemed to be very much more injured by the drouth than on the heavier land. It produced a heavy growth of straw which lodged badly, and gave a shrunken, poor quality of grain. The fly did serious damage to this variety; the others being little affected.

Rogers' Amber.

Nine bushels of this variety were sown on six acres next to the Clawson. Sown Sept. 19, harvested July 14. Yield, 159 bu., 26½ bu. per acre.

This variety has stiff straw of medium length, stands up well, is hardy and has given good satisfaction wherever it was sown last season as far as I have been able to learn.

We have grown it two years; obtaining our seed from Hon. Henry Chamberlain, of Three Oaks, who introduced it in 1883, I believe, from Pennsylvania.

YIELD FROM DIFFERENT AMOUNTS OF SEED.

Martin's Amber.

The next four acres were sown to this variety, with different amounts of seed to each measured acre.

The four plats were sown the 20th of Sept., harvested July 13th.

First acre, 45 lbs. (¾ bu.) of seed. Yield, 21 bu.
Second acre, 60 lbs. (1 bu.) seed. Yield, 24½ bu.

Third acre, sown with 75 lbs. (1¼ bu.) Yield, 26½ bu.
Fourth acre, sown with 90 lbs. (1½ bu.) Yield, 26 bu.

The yield is a half bushel more per acre from five pecks than from an acre sown with six pecks. I incline to the opinion that 1¼ bu. of clean seed properly sown is enough on well prepared soils. We shall continue the test the coming season.

Champion Amber.

On east side of field, 5.45 acres of Champion Amber was sown with 7¾ bu. of seed, 1.4 bu per acre.

Sown the 21st of Sept., harvested July 12, 1886. Yield, 179 bu. 32.84 bu. per acre.

This variety we have grown in plats of increasing size for three years. It has proved hardy. Straw strong and of medium length, heads medium size, smooth, white chaff. Is a good, yielding variety.

I may add, this field was in excellent condition at the time of seeding. The wheat was sown with the Beckwith Roller Drill. As a rule, we prefer not to sow before the 15th of September, especially if the fly has injured the last crop.

The Experimental plats were sown the 23d and 24th days of September in Field No. 3.

The soil varies from quite light sand in the higher portions to a heavy clay loam on eastern side, which is tiled but from lack of sufficient fall suffers from excess of water during and after heavy rains. Portions of many of the plats were seriously injured and the imported varieties entirely destroyed by the winter, as the notes that follow detail.

The different varieties ripened very unevenly, which accounts for the cutting of some plats, extending over several days.

The following table gives some of the more important points of these varieties, and supplemented by the notes that follow makes the history of the wheats sown in fall of '85 measurably complete:

Number.	Name of Variety.	Experimental Plats.			Bearded or Smooth.	Length of Straw.	Yield, Bushels.
		Date of Sowing.	Per Cent winter killed.	Date of Cutting.			
1 acre	Surprise	Sept. 23.	.20	July 13	Smooth.	3 ft. 10 in.	15
1 acre	Wysor	Sept. 23.	.25	July 13	Smooth.	3 ft. 10 in.	17⅙
1½ acres	Rogers' Amber	Sept. 23.	.25	July 9-12	Smooth.	3 ft. 11 in.	10
½ acre	Martin's Amber	Sept. 23.	.25	July 12-13	Smooth,	3 ft. 5 in.	9
½ acre	Acadia	Sept. 23.	.20	July 8-12			12½
Plat	Early Oakley	Sept. 23.	.50	July 7	Smooth.	3 ft. 1 in.	¼
Plat	McGhee's White	Sept. 23.	.25	July 7	Smooth.	3 ft. 8 in.	½
Plat	Diehl Mediterranean	Sept. 23.	.25	July 7	Bearded.	4 ft. 2 in.	1½
Plat	White Australian	Sept. 23.	.15	July 7	Smooth.	3 ft. 6 in.	½

NOTE.—Genoese, White Crimean, Egyptian and India wheats entirely destroyed.

CONDITION OF PLATS AT OPENING OF WINTER. NOTES TAKEN DECEMBER 4, 1885.

Early Oakley.

Very dark green. About 75 per cent came up. Lays very close on ground. Spread out very nicely.

McGhee.

About 90 per cent came up. Leaves short but thick around stalk. Lays close on ground. Well spread, and healthy.

Diehl Mediterranean.

Good growth, lays close on ground. Spread well. Strong and healthy. About 90 per cent dark green color.

Crimean, Imported.

About 75 per cent came up and has made good growth. Does not spread as much as some of the other varieties.

Indian, Imported.

Not more than 5 per cent came up. Has good growth and good color. Very slim stalk.

Genoese, Imported.

Came up well, and has a good growth. Well spread, and in good condition for winter. Light green in color.

White Australian.

Short thick growth. Leaves narrow. Well stooled, and lays close on the ground. About 90 per cent standing.

Surprise.

Very good growth, but rather thin. Does not stool as much as some of the other varieties. Good color.

Acadia.

Very good color and strong growth. Spreads out well. Will go into winter in very good shape.

Wysor.

Rather thin. Does not stool as much as some other varieties. Has good growth and color.

Martin's Amber.

Not thick on the ground. Does not lie so close to ground as some other varieties. Has a healthy look.

Rogers' Amber.

One of best appearing varieties at this date. Good color and well spread, lying close on ground.

Champion Amber.

Good growth and stands up strong, but not as large as some other varieties.

Martin's Amber.

Very good growth and well stooled.

Egyptian Wheat.

Light colored. Stands up very straight. Does not stool much. Came up well and has made a good growth.

NOTES ON WHEATS MADE APRIL 19, 1886, SHOWING THEIR CONDITION AFTER PASSING THROUGH THE WINTER.

Champion Amber.

This variety did not winter-kill very badly in field or in small plat.

It had rather the advantage over some varieties, as it was sown on a dryer soil. Rather thin on ground, but plants present a healthy, vigorous appearance.

Martin's Amber.

Stands well on high ground, low places badly winter killed. Plants strong in best portions of plat and field.

The imported wheats received from the Department of Agriculture, which promised so well in the fall, White Crimean, Egyptian, Genoese and Indian are entirely winter-killed. Not a single stalk shows vitality.

Early Oakley

Was not entirely killed, but seriously damaged. It was sown on light, dry soil next to the imported varieties, but is too tender for our latitude.

McGhee's White.

Was slightly injured by the winter; but is in fair condition. Plants seem strong and healthy.

Diehl Mediterranean.

This seems a hardy variety. Has not been affected by the winter. Plants are strong, of good color and cover the ground.

White Australian.

Notes on Diehl Mediterranean apply to this variety.

Acadia.

Slightly injured by the winter and rather thin on ground. Plants of good color and strong growth.

Rogers' Amber.

In the field this variety stood the winter fully as well as the Clawson, Martin, or Champion Amber.

In the Experimental plats it was more injured than the Acadia, Wysor or Diehl Mediterranean, but compares fairly well with the other varieties.

Surprise.

Is in fair condition but not as vigorous and promising as the Wysor on adjacent plat. Is thin on ground and plants spindling; rather than stocky in appearance.

Wysor.

This variety has proved hardy and promises well except on a low place in plat which has been injured by standing water. It is vigorous, good color and covers the ground well.

NOTES ON WHEAT SOWN IN FIELD NO. 8.

Champion Amber.

June 14, 1886.—Nearly all in blossom. Heads slightly bearded, especially near the top. Length of head about 3 inches, but sometimes only 2, 2½.

Straw above the last leaf of a dark blue tinge. Some heads of smut. Stalks bearing them usually much shorter than the average length of straw. Many of the lower leaves are turning brown. Straw stands well and has the appearance of rank growth in most places.

June 22, 1886.—Average length of straw is about 3½ feet.

June 24, 1886.—This variety was the best in the field. Stands quite even, heads good length; as far advanced as the Clawson.

July 1, 1886.—Leaves all dead. Straw turning. Still in milk.

Rogers' Amber.

June 14, 1886.—Wheat in blossom. Straw above last leaf dark blue, and resembling the Champion Amber. Straight and thick in most places. Lower leaves yellow. But little smut.

June 16, 1886.—This variety seems to be affected by dry weather more than other varieties in this field.

June 22, 1886.—Straw about 3½ feet in length. Heads about 2¾ inches in length and small. Slightly affected by rust.

Martin's Amber.

June 14, 1886.—Mostly in blossom, except in the center of the field there is a strip where wheat is thin and short. Slightly bearded at tip. Heads about same length as Champion Amber. Straw above last leaf is of a whitish blue color. Straw about 3–3½ feet long. Color of heads give plat a whitish appearance.

June 22, 1886.—There is a slight appearance of rust.

July 1, 1886.—Straw looks quite white. Grain not as ripe as Champion.

July 6, 1886.—Grain out of milk. Straw some green.

Clawson.

June 14, 1886.—Heads slightly bearded at the top and in blossom. About 3 inches in length. Smut is quite plentiful.

June 16, 1886.—Mostly past blossom. Lower leaves are turning yellow. Insects are working in this variety.

June 24, 1886.—Length of straw 3½ feet. Heads are somewhat affected with rust. Insects are working badly, and wheat is going down on account of it. More rust in this plat than in any of the others.

NOTES ON EXPERIMENTAL WHEAT PLATS IN NO. 3.

Early Oakley.

June 22, '86.—Badly winter killed. Heads of medium length but loose. Beardless. Thin on ground. Six stalks to the stool. No rust or smut, but a number of heads are drying up and the kernels are dropping off. Most forward of any variety.

June 30.—On light, sandy soil is very poor. Straw uneven and rusty. Heads loose.

July 1, '86.—The one thing quite noticeable is the amount of covering to kernel, which is much thinner than the other kinds. This will make it shell easier when ripe. Not out of milk.

McGhee's White.

June 22, '86.—Heads from $2\frac{1}{2}$ to 3 inches in length and loose. Thin on the ground, from 3 to 4 stalks on a stool. Very little smut and no rust. Straw $2\frac{1}{2}$ to 4 feet high and quite strong. About as forward as White Australian.

June 23, '86.—Some rust on the leaves. A good many stalks are cut down by "the fly."

June 25, '86.—Does not look well. Heads long and slim but not compact. Grain almost out of milk.

June 30, '86.—Is ripening unevenly. No smut.

July 1, '86.—Straw looks quite ripe.

Diehl Mediterranean.

June 22, '86.—Darker color than the White Australian and not quite so forward. Heads about three inches long. Bearded. Straw long and strong, about four feet in length over whole plat. No smut or rust. 3 to 6 stalks to the stool. Thick on the ground.

June 25, '86.—Wheat stands well and looks like the "Treadwell."

June 30, '86.—Ripening evenly and the kernel just beginning to harden.

July 1, '86.—Full as far advanced as White Australian. Would do well to cut now, being hard and plump.

White Australian.

June 22.—Heads 2 to 3 inches in length. Heads quite compact and well filled. Light green in color and turning yellow. Some smut but no rust. Straw from 3 to 4 feet in length and strong. 3 to 6 stalks on each stool.

June 25, '86.—Most of it still in the milk.

July 1, '86.—Is out of milk. Will do to cut in two days if weather continues dry. Grain plump but not large berry.

Wysor.

June 30, '86.—Straw medium length. Heads of fair length but rather loose. Ripening evenly. Is about as far advanced as Martin's Amber.

July 1, '86.—Still in milk. Leaves nearly dead but the straw appears green.

July 6, '86.—Stiff dough state. Straw quite ripe. Will do to cut.

Martin's Amber.

June 22.—Green in color and not very forward. Beardless. Heads are long and slender. Straw about $3\frac{1}{2}$ feet in length. Some little smut but no rust. Thin on the ground.

July 1, '86.—This variety stools much more than the others. Heads quite long. Grain not out of milk.

Surprise.

June 30, '86.—Poor generally. Our best soil straw is of fair length, with compact heads. Is a few days earlier than Martin's Amber.

July 6, '86.—Straw quite ripe. Grain hard, chaff has a red tinge.

The Diehl Mediterranean and the imported varieties were from seed furnished by the National Department of Agriculture.

The Acadian (a name I use to designate the variety, as it came to us nameless) was from seed sent us by Mr. Geo. M. Selleck, Imlay City, Mich. A variety secured by selection and yielding well, Mr. S. informs me.

We invite the suggestions of farmers and all interested; that in the continuance of this work of testing varieties, etc., the most practical results are secured.

SAMUEL JOHNSON,
Prof. of Agriculture and
Superintendent of the Farm.

AGRICULTURAL COLLEGE,
Sept. 4, 1886.

No. 19.—DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING.

NOTES ON TOMATOES.

Seventy-six so-called varieties of tomatoes have been grown in the college garden this year. It was the intention to grow all the sorts advertised in American catalogues, but two or three kinds were overlooked. There are several reasons for undertaking this experiment. There has been very little attention given to tomato culture in scientific or experimental establishments, although the importance of the crop is very great. The varieties of tomatoes are now so numerous and their individual merits so evenly praised that the inexpert cultivator is confused. The tomato rot is also becoming a serious difficulty. Methods of training and culture need to be discussed. Moreover, there has been no scientific discussion, so far as I know, of the methods or directions of variation, the origins of varieties, etc.

The most important as well as the most difficult of these problems is that of determining which varieties are duplicates. There is probably no garden plant which is so difficult to study in this respect as the tomato, from the fact that varieties are characterized almost entirely by the color, size and shape of a fruit which is of all others the most variable. Moreover, the tomato has been in general cultivation so short a time that varieties are not yet fixed. Add to these facts the hasty and bungling methods or lack of method of seedsmen and others in securing the so-called new varieties, the wide variations of the same varieties on different soils and under different managements and the frequent mixing of stocks by careless parties, and the task of determining duplicates appears to be almost hopeless. But the very difficulty of the task is all the more reason why it should be grasped. This whole matter of determining the synonymy or the duplicates in cultivated plants, together with the reformation of garden nomenclature, is exceedingly important. None are so well qualified to undertake this work as many of our seedsmen and it seems strange that they should be the very ones who make the work necessary. The time can certainly not be far distant when the most popular seedsmen will be those who exercise the most care in excluding "novelties" and unnecessary varieties.

This experiment is only initiative. It will be continued and varied in succeeding years with the addition of all European varieties. Two of the varieties purchased are not tomatoes: the tree tomato of Jamaica, which is evidently some solanum of the egg-plant sort and which does not fruit until the second year, and the strawberry tomato or winter cherry, *Physalis pubescens*, the decumbent "ground cherry" of our fields. The most noticeable feature of the tomatoes is the great similarity of most of the kinds. Upon close examination, one observes that all the larger varieties are exceedingly variable,—it is difficult to select a type. I imagine that this variation is due to the unfixity of varieties rather than to mixing from cross-fertilization. In fact, Professor W. W. Tracy finds that plants grown from cuttings from one parent vary in the same manner, though not so extensively, as those grown from seeds. With this fact before us we can appreciate the impossibility of securing new and permanent varieties from a few years of selection. Seedsmen grow the same variety from different "stocks" of seeds. They select according to different models. As a consequence, these stocks sometimes soon appear under the names of new varieties, although they may have gained no fixity, nor have been widely developed. In the synopsis on a succeeding page, I have expressed my judgments as to the systematic merits of varieties. These judgments were drawn from this year's experiment alone, and although I have spent weeks in the critical study of the varieties, I have not been able to reach satisfactory results in many cases. Another year's study may reveal many errors. Different weather and different treatment, with seeds from different sources, may make many changes necessary. I have reduced the list of varieties nearly one-half. I am confident that this reduction will need to be reduced nearly another half upon further study. It is probable that some of our varieties have not been true to name.

I have also endeavored to present in the synopsis a systematic and scientific classification of varieties.

Training.—Three methods of training were employed this year, and another method last year. All the experimental tomatoes were tied to one, two or three stakes about four feet high. This method has many disadvantages. It requires much labor to tie the plants, a labor which must be repeated at short intervals throughout the growing season. The tomatoes do not ripen evenly and early and it requires extraordinary time and labor to pick them from the dense mass of stems and foliage. Although the outlay for the stakes is small, this method of training is still the most expensive of the four. Last year we laid old boards lengthwise the rows and close to the plants, supporting them upon pieces of scantling or blocks laid upon the ground, and placed straw upon the boards. This method kept the tomatoes clean, but it appeared to increase the rot. It certainly caused the lower ripe tomatoes to rot prematurely. In our market patch this year we adopted two sorts of racks. The first was a separate rack for each plant. A stake was driven on either side of the plant, about fifteen inches from it, and leaning so as to make an angle of about twenty degrees with the perpendicular. Upon these stakes three cross-slats were nailed, in the manner of a ladder. The plant was allowed to lop upon the racks. It was found necessary to tie it, however, and even then branches slipped off or broke themselves over the slats. The second of these racks was continuous throughout the row. About every six or eight feet a stout stake was driven on either side of the row and fifteen inches from the plant, the stakes when firmly driven standing some over a foot high. A strip of old boards was nailed near the tops of the posts along either side of the row. Then edgings were tacked across from one side to the other, four about each plant and a foot apart. The plant now found itself growing up between the horizontal edgings. and as it began to lop the rack held it above the ground. Upon this simple rack the tomatoes needed no tying nor training and they spread themselves freely to the sunlight. The circulation of the air under the racks was so free that there was no unusual danger from rot. This is decidedly the best rack which we have tried. We noticed, also, that the fruit ripened more uniformly here than on the plants which were tied to stakes. We shall try other methods of training next year. It appears advisable to try but a very few sorts each year in order that they can be tested upon a larger scale.

Tomato Rot.—Our green tomatoes have rotted to an unusual extent this year. The rot first appears as a slight spotty discoloration about the apex of the tomato, gradually extending and becoming darker until the whole top of the fruit sinks in. The disease attacks the fruits at any time after they are a third or quarter grown. It threatens to become a serious obstacle to tomato growing. It is commonly supposed that in such dry years as the present rots are not prevalent. Tomato rot is, of course, of fungous origin. The microscope reveals abundance of bacteria and the mycelium of some higher fungus, as well as occasional isolated septate spores. Professor Arthur * has made numerous inoculations from cultures of the bacteria but has not produced the rot. Hence he concludes that some higher fungus produces the disease. As yet we know of no remedy or preventive. The first preventive which suggests itself is to plant varieties which are least liable to attack. E. S. Goff † is of the opinion that the fruits on the most vigorous plants are most liable. Such has not been our observation. We occasionally observe plants in no way distinguishable from others, which are nearly exempt while all the contiguous plants are much affected. We have made careful observations upon the average per cent. of rot in each variety. These observations are recorded in the last column of the table. It will be observed that the per cent. of disease is ninety or above in Emery, Paragon, Rochester, Livingston's Acme, Market Champion, Golden Queen, Perfection and Livingston's Favorite, while among the market varieties the per cent. is nothing or unimportant in Prize Belle, Advance, Mikado, Yellow Victor, Red Valencia Cluster, Precursor, Fulton Market, Golden Trophy, Island Beauty, Boston Market, Golden Queen, Conqueror, Gen. Grant, Cardinal, Trophy, Criterion, Canada Victor, The Cook's Favorite, Hundred Days and Alpha. Although these figures are striking, they may nevertheless be the result of accident. The affected varieties were scattered among the others, however, causing them to appear as if especially liable to attack. Further observations must be made before conclusions can be reached. In some cases the same variety from different sources showed marked differences in amount of rot. For instance, Livingston's Favorite from Henderson showed 20 per cent. of rot, from Sibley, 90 per cent.; Cardinal from Henderson, 5 per cent., from Sibley 75 per cent; Queen from Henderson, 10 per cent., from Nellis, 75 per cent.; Golden Queen from Rawson, none, from Burpee, 90 per cent. As there is no reason to suppose that the disease is conveyed in the seeds, it would seem that its appearance is accidental. It is singular that the angular varieties (see Synopsis), the cherry and pear-shaped varieties and those immediately derived from them have been almost exempt from attack. The disease ceased to do much damage late in the season.

---

* Rep. N. Y. Exp. Sta., iii., 379.
† Rep. N. Y. Exp. Sta., iv., 183.

It appears probable that rotation in cropping will prevent the disease to some extent, although Professor Arthur,* from an experiment conducted for the purpose, is inclined to think otherwise.

Productiveness.—An average plant of each variety was pulled up when the first picking was well matured and the plant and its fruit separately weighed. While this method of determining productiveness does not give the absolute weight of produce of each plant—many of the fruits being but partially grown—it nevertheless gives an accurate relative knowledge of the productiveness of varieties. The most prolific variety—the one which shows the greatest ratio of fruit to weight of plant—is not always the most profitable, even when earliness and quality are not to be considered; that is, the plant itself must not be too large, else the cost of training it will be too great. Other things being equal, the lowest plant is usually the most profitable. I expect that the same variety will vary much in productiveness in different years and under different treatments. In fact the same variety from different sources varied widely this year, as for example, the Queen, Cardinal, and Golden Queen. The second and third columns of the table give the weights. The best ratios occurred in Mikado, Trophy, Canada Victor, Hundred Days, Precursor, Livingston's Beauty, and "Large Red Smooth Round." As an illustration of how much cultivation has increased the productiveness of the tomato, compare the ratios of the cherry and pear-shaped tomatoes and their immediate offspring with those of the best market sorts.

Varieties.—The earliest varieties were Advance, Precursor, Boston Market, Tom Thumb, Conqueror, and The Cook's Favorite. These all began to ripen about August 6th. The early season was so very dry that none of the varieties produced fruit so early as they should have done. The seeds were all sown in a forcing house March 18th, and transplanted, ten of a kind, to the open ground June 7th and 8th. It is probable, however, that small differences in earliness are not to be relied upon in estimating varietal characters. Careful experiments upon this point, running through three or four years, conducted at the New York Experiment Station, show great variations in the comparative earliness of varieties. We have made records of the first flowering and fruiting for future comparison. Although the list of varieties as reduced contains some forty sorts, all the desirable kinds for general cultivation are not more than six. From our experience, I should select the following six: Boston Market, Conqueror, Red Valencia Cluster or Queen, Trophy, Livingston's Beauty, Paragon. If the rot should continue to attack the Livingston's Beauty and Paragon to the same extent as this year they will need to be discarded. The Trophy is apt to grow too irregular.

In order to determine if all seedsmen send out the same tomato under the same name we grew Paragons from nineteen sources. Although all these plants bore fruits which had most of the essential features of the Paragon, it is nevertheless an easy task to select from the patch whole plants which might be taken to represent several different varieties. This fact simply proves again the unfixity of varieties and the necessity of exercising caution in sending out new ones.

I append a Synopsis of cultivated tomatoes. I acknowledge aid which I have derived from the records of tests made at Chiswick, England,† in 1867, and at the New York Experiment Station, in very recent years. References to these records will be found in the text wherever I have used them. Following the Synopsis is a table of the varieties with names as we received them, supplemented by columns giving time of germination, productiveness, and per cent. of rot.

---

* Gard. Chron., 1869, 903, 1098.

† Rep. N. Y. Exp. Sta., iv., 250.

SYNOPSIS OF CULTIVATED TOMATOES.

I. LYCOPERSICUM ESCULENTUM, Miller, Gard. Dict. (1768). *Salanum Lycopersicum*, Linn, Sp. Pl., ed. i. 150 (1753). *Lycopersicum cerasiforme*, Dunal, Hist., Sol , 113 (1813). *L. pyriforme*, Dunal, l. c. 112. *L. esculentum* var. *cerasiforme*, Gray, Bot. Cal. i. 538; Syn. Fl. N. Amer. ii., part i., 226. Leaflets ovate-acuminate or lance-ovate, variously cut and parted.

This, the ordinary tomato, is a native of Peru. The original wild type is the form designated by botanists as *Lycopersicum cerasiforme*, "cherry tomato" of the gardens. The cherry tomato is still known in a wild state in South America, and it is either indigenous or spontaneous as far north as the lower border of Texas. It is distinguished from the ordinary market tomatoes by its weaker growth and its small, regular, spherical, two-celled fruit. It appears to have been early cultivated in Peru, there developing into some form of the common tomato. The first effect of domestication appears to have been the increasing of the number of cells in the fruit. This increase of cells is due in part to the doubling of the flowers by cultivation, and in part to the growth of adventitious cells after the fruit is partly grown. In some of the large irregular tomatoes I find as many as twenty cells. The dark "ring" which appears on the top of overgrown tomatoes marks a rupture, very gradual to be sure, of the cell divisions by the interposition, the forcing-in of new cells. These more or less developed new cells are often indicated by the excrescences within the "ring." The pear-shaped tomatoes, heretofore called *Lycopersicum pyriforme*, are evidently only cultural sports from either the original cherry tomato or its garden offspring. The pear-shaped and the larger garden tomatoes are unknown in a wild state. The tomato was grown in Europe in 1561,* and probably earlier. In 1583 the fruit was eaten upon the continent "dressed with pepper, salt and oil."† English authors speak of it in 1597‡ and 1656§, but mention it as grown for curiosity only. In 1752 Miller** records its use in England for flavoring soups. In 1819†† four red varieties were grown in Europe: Large Love Apple or Tomate grosse, Small Love Apple or Tomate petite, Pear-shaped Love Apple or Tomate en poire, and the Cherry Love Apple or Tomate cerise. There were two yellow varieties: Large Yellow Love Apple and Cherry Yellow Love Apple or Tomate petite jaune. As early as 1623* four sorts were known, the yellow, golden, red, and white. The white variety was even known to Besler in 1613.† Tournefort,‡ 1700, mentions seven sorts, among them one which was pale red. At the beginning of the nineteenth century three of these old varieties were unknown, the white, golden and pale red. As these are now present in our gardens, we must suppose that they have been re-originated. The cultivation of the tomato for market dates from about 1800 in England and about 1830 in this country. In 1847* three varieties were grown for the table in the United States, the Large Red, Large Smooth Red, and the Pear-shaped. The Cherry tomato appears to have been grown as a curiosity. During the last twenty-five years a perplexing catalogue of new varieties has been presented. Many of the varietal names current a few years ago have become extinct, although it is probable that most of the varieties which they represented are still grown under other names. The following are some of the old names which do not appear in catalogues this year: Bermuda, Large Red, Giant Apple, Improved Apple, Large Red Oval Fruited, Mexican, Round Yellow, Seedless, White's Extra Early, Funchal, Arlington, Keyes's Early Prolific, Early York, Maupay's Superior, Mammoth Chihuahua, Cedar Hill Early, Foard, Eureka, Chorlton's Prolific, Early Dwarf Red, Sims's Early Cluster, Grape Shot, Turk's Cap, Blount's Champion Cluster, Howard, Lyman's Mammoth Cluster, New Japanese, Painted, Powell's, Red Chief, Triumph, Early Richmond, Jones's Early Hybrid, Wonder of Italy, Standard Market and Shipping, Red Plum.

---

* Anguillaria, Simp., 217.
† Dodonæi Stirp. Hist, 455.
‡ Gerarde, Herball, 275.
§ Parkinson, Paradisus.
** Gardener's Dict.
†† Hort. Trans. Lond. iii., 347.

* Caspar Bauhin, Pinax, 167.
† Hortus Eystitensis.
‡ Inst. Rei Herb. i., 850.

§ A. VULGARE.—Common tomatoes. Plant weak, requiring support; leaves ordinary; fruit commonly as broad as long or broader, usually more than two-celled.

a. Market or marketable sorts:

* *Fruit red or pink:*

I. The angular tomatoes.—Fruit medium or below in size, mostly very flat, plane on top, more or less cornered, the lobes most conspicuous on the bottom and sides. This is the type of the original Large Red, the first market tomato. The type is almost lost in many of our later improvements, and it is now too inconstant, perhaps, to be relied upon as a sectional character. In all characters used in distinguishing cultural varieties, however, one must rely only upon the average of many observations. The old Large Red was mostly dropped from cultivation some fifteen or sixteen years ago. In 1818† tomatoes in England averaged about twenty pounds of fruit to the plant, some plants producing as high as forty pounds. The largest fruits somewhat exceeded twelve inches in circumference and weighed twelve ounces. These were probably the Large Red variety.

Leaflets "curled"; *i. e.,* involute.

1. *Tom Thumb.*—Plant small, two to two and a half feet high when tied; leaflets very much curled, so that the upper surface is often nearly hidden; fruit early, the larger specimens from two to three inches across, usually less than an inch and a half deep, mostly much angled, clear dark red, firm and meaty. A pretty sort, ripening early.
2. *Hubbard's Curled Leaf.*—Plant larger than in the last: leaflets less curled; fruit more variable in size and shape and approaching more nearly the character of the apple-shaped sorts, dark yellowish-red, firm.

---

* Buist's Family Kitchen Gardener, 126.

† Hort. Trans. Lond. iii. 346.

3. *Precursor.*—Plant a freer grower than in No. 2, the leaflets less curled or often nearly plane; fruit averaging a little larger, and darker colored. Evidently an improvement upon the last.

Leaflets plane:

4. *Orangefield.* (Dwarf Orangefield. Orangefield Dwarf Prolific.) Plant medium in size and growth: fruit small, strongly few angled, nearly as long as broad (about one and a half inches deep in ordinary specimens), yellowish-red, rather soft, often two-celled.—Evidently a short remove from the cherry or pear-shaped, rather from the Large Red. Said to be of English origin. Not desirable. At the Chiswick test it was found that in the Orangefield "the fruits are very large and corrugated or ribbed." That variety was surely not ours. It was said to be identical with the Large Red Italian.
5. *Hundred Days.* Strongly resembles Tom Thumb in fruit. Too small for its season.
6. *Conqueror.* Fruit much broader (often four inches or more broad) than in the last, oblong, bright dark red, firm. Fruit large and marketable for its season. A good sort. Said to be a cross between the General Grant and the Keyes. Introduced in 1874.

II. The Apple-Shaped Tomatoes.—Fruit various in size or shape, but in normal forms more or less rounded on top, the monstrous or overgrown specimens developing a scar-like line or ring on the top and the ends of the fruit turning downwards. The Apple tomato and the Paragon may be taken as types of this division.

Fruit red or yellowish-red :

7. *Boston Market* (Fulton Market). Fruit flattened, in average specimens about three inches broad the longest way by an inch and a half deep, somewhat cornered, bright clear red, firm. A good variety. The fruit inclines to become double and distorted.
8. *General Grant.* Normally more regular than the Boston Market, but inclining to irregular forms. The two are evidently not distinct. As figured and described at the time of its introduction (about 1870), this variety was much more regular in shape than at present.
9. *Alpha.* Very inconstant in size and form, the better fruits resembling Boston Market, from which it is probably not distinct. Not desirable.
10. *The Cook's Favorite.* Another variety of the type of the last four, differing, apparently, only in its somewhat lighter color, smaller size, and consequently more regular form. Originated in Burlington Co., New Jersey, some twenty years ago. Nos. 7, 8, 9, 10 and 11, as grown here this year, appear to be but slight modifications of the same variety. If such is the case, the name should be Boston Market, as that is the oldest.
11. *New York Market.* (Large Red Smooth Round. Large Red, not the original. Large Smooth. Round Red. Large Smooth Red.) Fruit mostly large and regular, about four

inches across, and two to two and a half inches deep, ripening evenly; bright light red; very firm. A good market sort. Our stock of "Large Red Smooth Round" was much mixed.

12. *Canada Victor.* Inconstant in size and shape, usually considerably flattened; about four inches broad, by two deep, variously lobed; bright light red; solid. A popular variety, but, as grown here this year, possessing no superior merits.
13. *Trophy.* (Nellis' Selected Trophy. Henderson's Extra Selected Trophy. Read's Island Beauty. Island Beauty.) The typical Trophy is flattish, about four or five inches across, by two and a half deep; regular, or very nearly so, often producing a small, regular ring on top; bright light red, with some shading of orange red; firm. In this form it is probably our best tomato, for all purposes. It is exceedingly liable to grow too large and irregular, however. The so-called selected stocks have shown no improvement over the ordinary stocks. Introduced in 1870, by Col. Geo. E. Waring, Newport, R. I.
14. *Bronze Foliage Trophy.* Stems, veins on the under side of the young leaves, and leaf-margins colored with indistinct, dark violet-purple, and the leaves darker dull green than in other plants; fruit similar to the last, a little later. When the plants were young, the "bronze" was very marked, and even at this time the darker color of the plants is noticeable at some distance.
15. *Queen.* (Cardinal. New Cardinal. Prize Belle.) Fruit very uniform, seldom contorted, flattened; ordinary specimens three to four inches across, and two inches deep; slightly lobed, somewhat angled; glossy yellowish red; firm and handsome. This is an extreme development of the Angular tomatoes; one of the most attractive varieties. At the New York Station the Queen, from Henderson, appeared to be identical with Red Valencia Cluster.
16. *Red Valencia Cluster.* Fruit somewhat more angular than No. 15, more uniform in size and ripening. Probably not distinct from the last. One of the handsomest sorts which we grew.
17. *Livingston's Favorite.* (Market Champion, Essex Round Red Smooth.) Distinguished from No. 15 only in its average smaller size and more regular form. Probably not distinct. Stock from Henderson was larger than from Sibley, and more indistinguishable from Queen. Our stock of Market Champion was mixed, a part of it being Acme or very near it. At the New York Station Essex Round Red Smooth was thought to be the same as Tilden.
18. *Hathaway.* (Hathaway's Excelsior. New Red Apple.) Ordinary fruit nearly spherical, one and a half to two and a half inches in diameter, perfectly regular, bright light red. A favorite sort. The New York Station regards Livingston's Favorite as the same as this. With us, however, the Favorite retains too much of the angled type to be associated with Hathaway. The Hathaway appears to be a direct develop-

ment of the cherry tomato, while the other is evidently a development from the old Large Red.

19. *Tilden.* (Tilden's New.) Smaller than the last, sometimes inclining to be a little angular. Probably not distinct. As described in the older catalogues the Tilden is a large tomato, but this was small. In the tomato test, at Chiswick, it was thought to be synonymous with Red Valencia Cluster, Lester's Perfected, and New Giant Fiji Islands (Feejee).
20. *Advance.* Several days earlier than the last; probably not distinct.
21. *Perfection.* (Livingston's Perfection?) Size and shape inconstant, but in general agreeing with the last two, from which it is evidently not distinct. Averages somewhat larger than the Tilden.
22. *Paragon.* (Emery. Autocrat. Mayflower.) Fruit constant in size and shape, three to four inches across and two inches deep, usually perfectly regular when ripe, bright light red, firm, and good. One of the best for main crop.
23. *Scoville.* (Scoville's Hybrid.) This variety did not reach us until about the middle of April, and consequently we could not make a legitimate comparison with other varieties. However, we could detect no difference between it and Paragon. The introducers say that "while it has the size and color of the Trophy, it has also the solidity of both the Trophy and Acme, and much earlier than the Paragon or Mayflower." As the plant is not a hybrid I reject the name under which it is introduced. Offered first this year.

Fruit Pink or Purple.

24. *Feejee.* (Feejee Island. Lester's Perfected. Rochester. Rochester Favorite.) Fruit large and commonly irregular, often more or less contorted and bearing the brown elongated or circular scar on the apex, very firm, late. Not valuable. A notion was once current that this tomato was introduced from the Feejee Islands. It is said by White* to have been brought into the vicinity of Athens, Georgia, from Naples, Italy, as long ago as 1848. Probably the first of the pink tomatoes.
25. *Acme.* Differs from the Paragon chiefly in its bright pink-purple color. Introduced in 1877. Popular.
26. *Livingston's Beauty.* More constantly large and fair than the Acme and brighter colored. The handsomest of the pink sorts. Perhaps not sufficiently distinct from Acme.
27. *Climax.* (Hovey. Livingston's Acme. Essex Hybrid.) Smaller than the Acme, average specimens measuring from two to two and a half inches across. The fruit grown under the name of Livingston's Acme rotted more than that grown under other names.

III. The Oblong Tomatoes. Fruit usually as long or longer than broad, the sides very firm.—Developments of the Pear-shaped tomato.

---

* Gardening for the South, 31?.

28. *Criterion.* (Vick's Criterion.) Average fruits, two to two and a half inches deep, and two inches broad; obscurely angled, more or less squared at the ends; pink-purple; commonly, two or three celled. Occasionally, by the interposition of adventitious cells, the fruit broadens, becoming three times broader than deep. Such fruits, growing on the same plant with those which are almost pear-shaped, illustrate the process through which our garden tomatoes have been developed from the wild type.

29. *King Humbert.* Fruit two and a half to three inches deep, by an inch or inch and a half broad, fig-shaped; regular, or nearly so; bright red; not ripening simultaneously on the stem end; two or three celled; scarcely acid. A short remove from the Pear-shaped tomato. Probably the best tomato for pickles and preserves. A European variety, introduced by the Rural New Yorker, and figured in that journal Nov. 8, 1884.

***Fruit yellow or orange:*

30. *Persian.* In shape and size, like the Conqueror; color whitish yellow.

31. *Golden Queen.* In shape and form, like the Paragon, or an occasional fruit showing a tendency to become angular; color bright yellow.

32. *Golden Trophy.* (Yellow Victor.) Strongly resembling Trophy in shape, but running a little smaller and often becoming somewhat angular; color, inconstant, usually bright yellow, often shading into orange or red.

33. *Improved Large Yellow.* Fruit small, an inch or an inch and a half in diameter, angled; in color, a rich dark orange; often but two celled.

34. *White Apple.* (New White Apple. Nellis' Snowball.) Fruit small and spherical, occasionally somewhat irregular, an inch or inch and a half in diameter; nearly white in color; not firm; often two-celled.

35. *Green Gage.* (Large Yellow.) Differs from the last only in its rich, yellow color. Nos. 33, 34 and 35 are small improvements upon the Cherry tomato; occasionally a fruit becomes irregular and contorted, an indication of the tendency of domestication.

b. Small berry-like sorts, *i. e.*, Cherry tomatoes. Fruit two-celled. (*Lycopersicum cerasiforme* Dunal.)

36. *Red Cherry.* Fruit spherical, three-fourths inch in diameter; deep, glossy red. Useful only for pickles, preserves or ornament.

37. *Yellow Cherry.* Differs from the last only in color.

§ B. GRANDIFOLIUM.—Large-leaved tomatoes. Habit and fruit as in section A; leaves very large; leaflets fewer than common (about two pairs), large (the blade three to four inches long and an inch and a half wide), entire, the lower side strongly decurrent. Leaves of the young plants entire! The terminal leaflet is often six inches long and four or more inches broad. This peculiar foliage occurs in Nisbit's Victoria also.

38. *Mikado* (Turner Hybrid). Fruit very large, usually irregular, much resembling Trophy, only that the color is pinkish-purple. Too irregular to be recommended.

§ C. VALIDUM.—Upright tomato. Stem very thick and stout, the plants nearly sustaining themselves, two to two and a half feet high; leaves very dark green, short and dense, the leaflets wrinkled and more or less recurved. An odd plant with much the aspect of a potato plant.

39. *French Upright or Tomate de Laye* (Tree Tomato. Tomato à Tige Roide). Fruit very irregular on the sides and base, more or less cornered, nearly as large as Trophy, flattened, bright yellowish-red, very late. Used for pot culture in France. A chance seedling in the garden of M. de Fleurieux, raised by Grenier, his gardener, some thirty years ago, at Chateau de Laye, near Villefranche, France.

§ D. PYRIFORME.—Pear-shaped tomatoes (*Lycopersicum pyriforme* Dunal). Fruits more or less pear-shaped, two celled, conspicuously pendant.

40. *Pear-Shaped.* Fruit about two inches long, slender, conspicuously contracted towards the base, regular, bright red. Occasionally a fruit becomes obscurely angled.

41. *Nisbit's Victoria.* Fruit smaller than in the last, more contracted towards the base, red; leaves as in group B. Said to be a seedling from Hathaway, but this is doubtful.

Yellow Plum. Fruits an inch and a half long; scarcely pear-shaped; regular; bright yellow; often three-celled.

II. LYCOPERSICUM PIMPINELLIFOLIUM Dunal, Solan. Syn. 3 (1816). *Solanum pimpinellifolium*, Linn. Sp. Pl. Ed. ii. 265. *Solanum racemigerum* Vilmorin. *Lycopersicum racemosum* of gardens. *Solanum racemiflorum* Vilmorin, Pl. Pot. 560, not Dunal. Leaflets round-ovate, obtuse, entire; plants, more slender and more diffuse than in L. esculentum.

This is the Currant tomato. It is a native of Peru and Brazil. It has probably not been long in cultivation. It is evidently the Grape or Cluster tomato of Burr's "Vegetables of America," 1863. The species has not yet been modified by domestication. The fruits are clear, bright red, somewhat larger than a very large currant, and are borne in long, two-ranked clusters. The plant is very ornamental. If trained upon a trellis, near a window, it would make one of the most attractive screens. The whole aspect of the plant is delicate.

Thirteen species of Lycopersicum, or native tomatoes, have been described. Many were described from plants in cultivation, whose native countries were unknown. Three of these species are now regarded as representing only our common garden tomato, and are therefore held to be synonymous (*L. esculentum, L. cerasiforme, L. pyriforme*); another (*L. pimpinellifolium*), is now in cultivation. Of the remaining nine, only two or three are now supposed to exist in nature; that is, the other six or seven were described solely from garden plants. These two or three remaining wild tomatoes are natives of South America They ought to be brought into cultivation.

Note.—Our *Optimus* stock was so badly mixed, or so unfixed in its character, that we could make no satisfactory estimate of its character. A part of it appeared to be Hathaway and a part Climax.

TABLE.

Variety.	Time of Germination. Days.	Productiveness.		Per cent of Rot.
		Plant. Lbs.	Fruit. Lbs.	
From Peter Henderson & Co:				
Queen	12	7¼	17½	10
Hathaway's Excelsior	13	13½	22½	20
General Grant	13	10¾	25¾	5
Cardinal	12	12	13	5
Conqueror	14	7	19	2
Mayflower	15	10	16½	25
Mikado	16	8½	25½	2
Paragon	17	9¼	14½	90
Perfection	15	10½	16	98
Trophy	15	6½	17½	0
Golden Trophy	12	13¾	21	5
Trophy, extra selected	17	14¼	24¼	2
Vick's Criterion	17	9¾	19	0
Canada Victor	17	7¾	22½	0
Acme	16	11¼	21	25
Livingston's Favorite	16	9¼	12¼	20
Free Tomato of Jamaica	43	----------	----------	----------
Pear Shaped	11	13½	10	0
Island Beauty	17	10¾	17¼	5
Green Gage	12	12½	22	0
Essex Hybrid	11	8	19¼	55
Yellow Plum	10	9½	16	0
Feejee Island	10	9	18¾	10
Red Cherry	17	16¼	11	0
Strawberry Tomato, or winter cherry	40	----------	----------	0
From J. M. Thorburn & Co.:				
Hundred Days	11	6	19	0
Red Valencia Cluster	12	8	19½	5
New White Apple	11	----------	----------	0
Bronze Foliage Trophy	11	----------	----------	40
Hovey	10	14¼	18	80
Improved Large Yellow	10	7¼	7½	1
Yellow Cherry	11	20½	10¾	0
New Currant	8	6½	9¾	0
New French Upsight	11	----------	----------	0
Alpha	11	8½	16¾	0
Read's Island Beauty	10	10½	19¾	75
From James J. H. Gregory:				
Livingston's Acme	11	12¾	20	90
The Cook's Favorite	12	8¾	18¾	0
Fulton Market	11	6	13½	5
Yellow Victor	11	10	21½	5
New Red Apple	11	9	17½	40
Tilden's New	12	10	18	10
Essex Round Red Smooth	11	10½	21	10
Rochester Favorite	13	7¼	17¼	25
Criterion	13	10¼	19	0
From the A. C. Nellis Co.:				
Hubbard's Curled Leaf	12	----------	----------	8
Nellis' Snowball	8	14¼	10¼	0
Queen	10	12	15½	75
New Cardinal	8	12	17¾	20
New York Market	10	11	15½	75
Nisbit's Victoria	10	7¼	25½	0
Persian	15	12	16½	15
Precursor	8	7	19¾	0
Nellis' Selected Trophy	8	9¼	13¾	5
From W. W. Rawson & Co.:				
King Humbert	11	11	21¾	0
Boston Market	10	7¾	18½	5
Tom Thumb	11	7½	15½	0
Golden Queen	8	13¾	22¾	0
Livingston's Beauty	11	5½	14½	50
Golden Trophy	8	11¼	22½	0
Emery	10	8½	9½	90
Climax	8	8	18¼	10

TABLE.

Variety.	Time of Germination. Days.	Productiveness.		Per cent of Rot.
		Plant. Lbs.	Fruit. Lbs.	
From Hiram Sibley & Co.:				
Optimus	11	----------	----------	75
Rochester	8	11¼	16¾	95
Large Red Smooth Round	11	7	20½	75
Dwarf Orangefield	17	14¾	17¼	0
Large Yellow	17	----------	----------	0
Autocrat	11	16½	27	65
Cardinal	10	16¼	22½	75
Livingston Favorite	10	8¾	17	90
From W. Atlee Burpee & Co.:				
Golden Queen	10	10¾	16¼	90
Turner Hybrid	10	12½	21½	15
From Robt. Buist:				
The Prize Belle	10	14	25	5
From Frank Ford & Son:				
Market Champion	10	9	16	90
Advance	10	8½	15¾	0
From A. D. Perry & Co.:				
Scoville's Hybrid	11	----------	----------	50

L. H. BAILEY, JR.,
Professor of Horticulture and
Landscape Gardening.

AGRICULTURAL COLLEGE,
September 30, 1886.

NO. 20.—CHEMICAL DEPARTMENT.

ANALYSIS OF COMMERCIAL FERTILIZERS.

Act No. 26 of Session Laws of 1885, requires the inspection and analysis of all commercial fertilizers (the retail price of which is more than ten dollars) before they are offered for sale in this State. In order to call the attention of manufacturers and dealers in commercial fertilizers to this law and to secure a prompt compliance with its requirements, I sent the following circular to all the interested parties:

CIRCULAR TO MANUFACTURERS AND DEALERS IN COMMERCIAL FERTILIZERS.

THE SALE OF COMMERCIAL FERTILIZERS IN MICHIGAN.

[No. 26, Session Laws of 1885.]

AN ACT to provide for the inspection of commercial fertilizers and to regulate the sale thereof.

SECTION 1. *The People of the State of Michigan enact,* That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer or party who causes it to be sold or offered for Sale within this State, shall file with the Secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State. *Provided*, That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office, together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections one, two, and three of this act, or who shall attach or cause to be attached to any such package of fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain, shall upon conviction thereof be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

At a meeting of the State Board of Agriculture held in Lansing, Dec. 1, 1885, the undersigned was appointed the agent of the Board to make the analyses of commercial manures contemplated in the foregoing act. The object of the law is to protect the purchasers and honest manufacturers, and to prevent or to punish fraud in commercial fertilizers.

The specimen for comparison of any fertilizer, with affidavit, and the fee for analysis must be deposited with the secretary of the Board on or before the first day of May each year.

Any manufacturer or importer who desires to avail himself of the benefits of the proviso in Sec. 3, should notify me of the names of agents selling the fertilizers in this State, and the place where they are offered for sale.

Specimens for analysis will be selected in the open market, and not received from the manufacturer or his agent.

For the sake of uniformity in the certificate required in Secs. 1 and 2 to be affixed to each package of fertilizer, and to be filed with the secretary of the Board, I recommend the following form of Certificate:

Name or trade mark --
Name of manufacturer --
Place of manufacture --
Net pounds in package --lbs.

Analysis. {
Percentage of available Nitrogen --
Percentage of Potash soluble in water --
Percentage of Phosphoric Acid soluble in water --
Percentage of Phosphoric Acid reverted --
Percentage of Phosphoric Acid insoluble --

It would be convenient to have the retail price for a ton (2,000 lb.) stated, though the law does not require this.

Any inquiries for information or communications on this subject should be addressed to R. C. KEDZIE,

February, 1886. Agricultural College, Mich.

Most of the manufacturers and dealers complied with the requirements of the law, yet I have reason to suspect that a few have tried to evade the law. As the law was specially framed to protect the farmers and fruit-growers from fraud in commercial fertilizers, by insuring that the article offered for sale shall really be what it is represented, I trust the farmers will assist the enforcement of the law by promptly reporting all parties offering such fertilizers for sale which are not found in the following report, which includes all the manufacturers whose fertilizers (15 in all) can lawfully be sold in this State.

Report of Inspection of Commercial Fertilizers

Manufacturer, and place where made.	Trade name of the Fertilizer.	Where the specimen was selected and name of dealer.	Composi-
Michigan Carbon Works, Detroit, Mich.	Homstead Superphosphate	Hort. Department of Ag. College	Claimed Found
Michigan Carbon Works, Detroit, Mich.	Jarvis Drill Phosphate	From the manufacturer	Claimed Found
Cleveland Dryer Co., Cleveland, Ohio	Buckeye Phosphate	From the manufacturer	Claimed Found
Northwestern Fertilizing Co., Chicago, Ill.	Garden City Superphosphate	C. Winne & Son, Adrian	Claimed Found
Northwestern Fertilizing Co., Chicago, Ill.	Challenge Corn Grower	C. Winne & Son, Adrian	Claimed Found
Northwestern Fertilizing Co., Chicago, Ill.	$26 Phosphate	W. A. Newton, Lansing, Mich.	Claimed Found
Western Union Chemical Co., Cleveland, Ohio	Empire Superphosphate	S. Mathewson & Co., Flint, Mich.	Claimed Found
Western Union Chemical Co., Cleveland, Ohio	International Superphosphate	S. Mathewson & Co., Flint, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Ammoniated Bone Superphosphate	Roath & Van Doren, Adrian, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Potato, Hop, and Tobacco Superphosphate	W. A. Newton, Lansing, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Pure Ground Bone	W. A. Newton, Lansing, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Vegetable Bone Superphosphate	F. A. Platt & Co., Flint, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Queen City Superphosphate	F. A. Platt & Co., Flint, Mich.	Claimed Found
Crocker Chemical Works, Buffalo, New York	Buffalo Superphosphate No. 2	Roath & Van Doren, Adrian, Mich.	Claimed Found
Gerber & Sons	Michigan Fertilizer	From the manufacturer	Claimed Found

as Required by Act No. 26 of Session Laws of 1885.

tion of fertilizers as claimed by manufacturers and as found on chemical analysis—Percentage estimation.

Active nitrogen.	Nitrogen as ammonia.	Phosphoric Acid, P_2O_5.				Potash soluble in water.	
		Soluble P_2O_5.	Reverted P_2O_5	Insoluble, P_2O_5	Total P_2O_5	As oxide K_2O	As sulphate K_2SO_4
1.85 to 2.40 2.05	2.25 to 3.15 2.49	8 to 11 7.85	2.45	.... 1.2	.... 11.5	1.48 to 1.90 1.77	2.75 to 3.50 3.21
1 to 1.65 1.23	1.25 to 2 1.5	7 to 8 5.7	.5 to 1.5 1.9	2 to 3 2.8	.... 10.4	0 0	0 0
2.50 to 3.30 2.84	3 to 4 3.45	8 to 9 6.75	1.25	2 to 3 3	10 to 12 11	1 to 2 1.1	....
1.64 to 2.47 1.77	2 to 3 2.15	9 to 11 5.5	1	2 to 4 6	11 to 15 12.5	1 to 2 1.5	....
1.64 to 2.47 2.48	2 to 3 3.00	9 to 11 5.5	.7	2 to 4 4	11 to 15 10.2	1 to 2 1.3	....
1.23 to 1.64 1.4	1.50 to 2.00 1.70	6 to 8 5.38	1.12	2 to 4 4.5	8 to 12 11	0 0	0 0
1.03 to 2.06 1.23	1.25 to 2.5 1.50	9 to 12 8.5	1.5	3 to 5 2	12 to 17 12	0 0	0 0
0 0	0 0	12 to 14 6	1.25	2 to 4 2.75	14 to 18 10	0 0	0 0
2.9 to 3.7 3.36	3 5 to 4.5 4.08	6 to 8 6.8	2 to 4 2.4	1 to 2 1.2	9 to 14 10.4	1 to 2 2	1.85 to 3.70 3.70
2.16 to 2.88 2.49	2.5 to 3.5 3.00	6 to 8 6.5	2 to 4 1.7	1 to 2 1	9 to 14 9.2	3.5 to 4.5 3.95	6 to 8 7.4
2.88 to 3.70 2.48	3.5 to 4.5 3.06	0 0	0 0	25 23.5	25 23.5	0 0	0 0
5 to 6 5.5	6 to 7 6.7	4.5 to 5.5 6	1.5 to 2.5 2.70	1 to 2 1.3	7 to 10 10	6 to 8 5	11 to 15 9.25
1.65 to 2 1.9	2 to 2.50 2.3	6 to 8 6	2 to 4 5.3	1 to 2 1	9 to 14 12.3	1 to 2 2	1.85 to 3.70 3.70
0 0	0 0	10 to 12 9.25	1 to 2 2.25	1 to 2 1	12 to 16 12.5	1 to 2 1.5	2 to 4 3
.62 .64	.75 .78	0 0	0 0	.70 .75	.70 .75	1.4 1.2	....

AGRICULTURAL COLLEGE,
October, 1886.

R. C. KEDZIE,
Prof. of Chemistry.

No. 21—BOTANICAL DEPARTMENT.

LESSONS ON GROWING FOREST TREES.

Of the various things attempted since my connection with the Agricultural College few have given greater satisfaction, considering the outlay of time and money, than the selection and growing of trees. In the summer of 1875 a small beginning was made towards an arboretum, which has since that time been enlarged, till it now covers about two acres of land. The spot is relatively low, the soil a sandy loam, most of which is naturally well drained. A part of the lot was at one time occupied by a nursery, and the trees were not all removed at once, hence the trees now standing are of different ages. There are at present two hundred and fifteen (215) species of trees and shrubs, many of which are different from any in the college park.

Till a person begins to plant and cultivate trees and shrubs, as here attempted, he does not realize how little any one in this country knows about the best sorts to select and how to treat them from the seeds to mature trees. For want of information mistakes have been made, but even these mistakes often teach as much as the successes. Whether Michigan men ever grow forest trees for profit or not, the information acquired in growing an arboretum has already been the means of helping to answer many inquiries, and is likely to help in answering many more.

We are often asked what trees or shrubs are hardy at the Agricultural College and vicinity. The hardiness of a tree depends on many things—as elevation, soil, drainage, exposure, cultivation, rapidity of growth, whether crowded or grown with plenty of room, the nature of the summers, springs and winters, or any one or all of these, and doubtless on still other conditions.

Last winter was as cold as any we have had in 20 years—33° F. below zero—yet thrifty sprouts of *Magnolia umbrella* remained alive to the terminal bud. Perhaps this was owing to the fact that there was plenty of moisture in the soil, or little wind or no sunshine during the freezing period, or all of these combined, or for some other reason not yet understood. These magnolias have usually, even in mild winters, died to the snow line.

For six years a number of trees of the American persimmon have died every winter near to the ground. From this I supposed I was warranted in pronouncing this well-known tree as tender in Central Michigan. Two years ago I chanced to visit a garden on high clay land, less than ten miles distant, where young trees of the same kind were healthy and hardy, and had borne fruit two seasons in succession. Whether this difference was all owing to the difference in soil, or elevation, or cultivation, or the different locations from which the seed was procured, or from other causes, I am still uncertain. Other instances of a similar nature could be given.

In starting the trees in the arboretum the seeds were usually planted when freshly gathered, just where the trees were to remain. The rows are four feet apart and run north and south. For five or six years, and in some cases more, they were regularly cultivated like a field of corn till about the middle of August, and again late in autumn. As the trees crowded some were cut out. A very little trimming has been done by way of removing dead limbs and preventing bad crotches.

After the trees had got a good start and shaded the ground pretty well, cultivation generally ceased, as it seemed as though they would take care of themselves, but June grass and some other grasses and weeds soon crept in and partially occupied the ground, apparently retarding considerably the growth of the trees. The grasses and weeds which seem to do the most harm are capable of growing late in autumn and early in spring, while there is no foilage on the trees to shade the ground or plants below.

The trees where slightly crowded show a marked difference in their habit of holding their lower leaves. The lower branches of black walnut, butternut and white ash die young, because they do not carry their leaves. The tops are thin, allowing sunlight to pass through to the ground and light up grasses, weeds and other undergrowth. On the contrary, white oak, swamp white oak, beech, sugar maple, dogwood, hazel, blue beech, choke cherry, poplars, and sprouts and seedlings of many others hold their lower leaves well. Some of the evergreens, such as white pine, arbor vitæ, red cedar and Norway spruce, also hold their lower leaves well. To save the expense of cultivation after a few years and to keep the grass out we need to know the best *nurses, i. e.,* the trees, shrubs or herbs which hold their leaves well in the shade. Forest leaves where deep enough keep out the grass, but the wind drives most dead leaves out of the arboretum. To get a few points on this topic of nurses, in October last I made quite a complete list of the broad leaved undergrowth of the arboretum. This included some 60 species. Some of those holding their leaves best, not forgetting those named above, are black cap raspberries, common milkweeds, desmodium, celandine, wild asters, golden rods, grape vines, seedlings of many trees or shrubs, such as black cherry, American elm, bitternut, low willows, catalpas, birches and box elders.

It may not be out of place here to notice some other peculiarities of the undergrowth. The lot now called the arboretum has been cleared apparently 25 years or more, and the nearest forest is mainly of white and black oak, about 30 rods to the northeast. We will except a small piece on the west, separated by a board fence. This lot contains bearing trees of swamp white oak, beech, hickory, bitternut, blue beech, hawthorn, white ash, sugar maple, black cherry, aspen, large toothed aspen, ironwood and American elm. Among the undergrowth are three kinds of oak, black cherry, sugar maple, beech, American elm, bitternut, hawthorn, sassafras, two dogwoods, white ash, spiræa, blue beech, gooseberry, willow, two sorts of grapes, Virginia creeper, also catalpa eleven rods southwest of bearing trees in the arboretum; white birches ten rods southwest of bearing trees; box elder four rods west of bearing trees; three sorts of poplars, hazel, ironwood, several sorts of willows, prickly ash, viburnum, elder, and very likely others.

From some experiments I find acorns of black oak in the soil did not remain alive for three years. Some of the seeds of the above plants I know are freely spread by the wind, as they have repeatedly been seen on the move. Squirrels I know carry some of the nuts and cover them. I have seen, while in the arboretum, a blue jay drop a good acorn. He has a peculiar habit of tucking acorns and beech nuts into cracks and corners of the bark of trees and stumps, and very likely forgets to return for them. Woodpeckers and crows are known to carry nuts and seeds and hide or drop them. Many birds we know eat berries and other fruits and scatter the undigested seeds where they may grow. The young oaks and bitternuts show that they started from nuts in the soil or on the surface, as the remains of the nuts are still to be found.

Additional studies will no doubt bring forth still more evidence in regard to the manner in which seeds are carried from one place to another, and make it clear to the minds of incredulous people how some kinds of trees may succeed other kinds, and yet force no one to believe in spontaneous generation.

After cultivation ceases some of the annuals, such as shepherd's purse, annual poa, pigweeds, "pusly" and others, are first to appear. Very soon June grass appears, and is a most persistent intruder and comes to monopolize much of the spare room.

Rapidity of growth is relative, variable and an uncertain element; still some trees are usually more rapid growers than others. To grow fast relatively a tree needs to have many good roots and branches clothed with an abundance of good leaves. For this it needs a suitable soil and climate, and room enough in which to spread itself. The south tree of the row is more exposed to the light than most of the rest, and is generally the largest.

I have made a selection, and below are given the age, height and diameter of the largest tree of its kind. The diameter is taken one foot from the ground. If there is no mistake in figuring the tree first mentioned made the slowest growth, and the one last named the fastest growth.

Table Giving the Age, Height, and Diameter of Different Trees.

Name.	Age, Years.	Height, Feet.	Diameter, Inches.
Swamp White Oak	11	12	2
Sugar Maple	10	18	2
White Pine	9	15	2½
Butternut	10	18	3
Black Walnut	9	16	3½
White Ash	10	28	4
Black Cherry	7	17	3
Basswood	10	25	4½
Red Elm	14	30	6½
Poplar Birch	13	30	6
Balsam Poplar	12	30	6
European Larch	13	28	7
Locust	7	25	4½
Chestnut	10	22	7
Catalpa speciosa	13	28	10
Silver Maple	12	35	10½

With reference to the above figures I may add that butternut does not hold out its rate of rapid growth as well as it promised for a few years at first. White ash has been checked for two years by bark lice. The locust trees are very fine and healthy, only a few in all, and were planted later than the trees on either side. The size of the chestnut tree, as given in the table, is considerably larger than any other tree of the kind. The catalpa is the one usually called hardy, but our trees are mostly damaged by cold winters.

We have no cottonwoods which have had a good chance, hence no example is cited above.

It is yet hardly safe to draw conclusions. Four years ago I should have advised planting *Catalpa speciosa* where durable timber was desired, but further time shows that the trees are likely to be short lived. Chestnut trees are not all healthy, and are very uneven in size.

At present I am admiring the locust trees for their very rapid growth, good health and fine appearance. Most likely they will not be much troubled with borers if they are scattered about among other trees which are a little taller, so as to shade the trunks of the locusts.

No attempt has been made to give all the notes which have been taken, but to notice a few things which seem to be of most interest.

W. J. BEAL,
Professor of Botany and Forestry.

November 1st, 1886.

MICHIGAN STATE AGRICULTURAL SOCIETY.

PROCEEDINGS AND AWARDS FOR THE YEAR 1886.

OFFICERS.

PRESIDENT—WM. CHAMBERLAIN, Three Oaks.
TREASURER—A. J. DEAN, Adrian.
SECRETARY—J. C. STERLING, Monroe.

EXECUTIVE COMMITTEE.

Terms expire January, 1887.

WM. BALL, Hamburg, Livingston Co.
JNO. C. SHARP, Jackson, Jackson Co.
A. O. HYDE, Marshall, Calhoun Co.
W. H. Cobb, Kalamazoo, Kalamazoo Co.
E. W. RISING, Davison Station, Genesee Co.
I. H. BUTTERFIELD, Port Huron, St. Clair Co.
JOHN LESSITER, Jersey, Oakland Co.
JAMES M. TURNER, Lansing, Ingham Co.
J. P. SHOEMAKER, Amsden, Montcalm Co.
M. J. GARD, Volinia, Cass Co.

Terms expire January, 1888.

ABEL ANGEL, Bradley, Allegan Co.
D. W. HOWARD, Pentwater, Oceana Co.
H. O. HANFORD, Plymouth, Wayne Co.
F. L. REED, Olivet, Eaton Co.
A. F. WOOD, Mason, Ingham Co.
FRANKLIN WELLS, Constantine, St. Jos. Co.
J. Q. A. BURRINGTON, Tuscola, Tuscola Co.
M. P. Anderson, Midland City, Midland Co.
JOHN GILBERT, Ypsilanti, Washtenaw Co.
C. W. YOUNG, Paw Paw, Van Buren Co.

EX-PRESIDENTS.

M. SHOEMAKER, Jackson, Jackson Co.
JAMES BAILEY, Birmingham, Oakland Co.
W. J. BAXTER, Jonesville, Hillsdale Co.
GEO. W. GRIGGS, Grand Rapids, Kent Co.
CHARLES KIPP, St. Johns, Clinton Co.
E.O.HUMPHREY, Kalamazoo,Kalamazoo Co
W. L. WEBBER, East Saginaw, Saginaw Co.
GEO. W. PHILLIPS, Romeo, Macomb Co.
HENRY FRALICK, Grand Rapids, Kent Co.
PHILO PARSONS, Detroit, Wayne Co.

STANDING COMMITTEES.

Business Committee.—A. O. Hyde, Marshall; J. C. Sharp, Jackson; H. O. Hanford, Plymouth.

Transportation Committee.—W. H. Cobb, Kalamazoo; J. M. Turner, Lansing; John Gilbert, Ypsilanti.

Committee on Finance.—M. P. Anderson, Midland; Franklin Wells, Constantine; D. W. Howard, Pentwater.

Committee on Premiums.—I. H. Butterfield, Port Huron; C. W. Young, Paw Paw; Henry Fralick, Grand Rapids; J. P. Shoemaker, Amsden; D. W. Howard, Pentwater; John C. Sharp, Jackson; G. W. Phillips, Romeo.

Committee on Rules.—Wm. Ball, Hamburg; A. O. Hyde, Marshall; Abel Angel, Bradley.

Committee on Reception.—Philo Parsons, Detroit; E. O. Humphrey, Kalamazoo, Wm. L. Webber, East Saginaw.

Committee on Programmes.—I. H. Butterfield, Port Huron; G. W. Phillips; Romeo; D. W. Howard, Pentwater.

Committee on Printing and Advertising.—A. J. Dean, Adrian; J. C. Sterling, Monroe; W. J. Baxter, Jonesville.

General Superintendent.—W. H. Cobb.

Chief Marshal.—A. O. Hyde.

EXECUTIVE SUPERINTENDENTS.

Cattle—I. H. Butterfield.
Horses—G. W. Phillips.
Sheep—D. W. Howard.
Swine—John Lessiter.
Poultry—J. Q. A. Burrington.
Miscellaneous—Franklin Wells.
Fine Arts—W. J. Baxter.
Music.—M. P. Anderson.
Children's Department—Philo Parsons.
Needle Work—Philo Parsons.
Manufactures—Henry Fralick.
Agricultural—Amos F. Wood.
Machinery—John Gilbert.
Farm Implements—Chas. W. Young, Abel Angel and H. O. Hanford.
Dairy—J. P. Shoemaker.
Vehicles—F. L. Reed.
Bees, Honey, etc.—M. J. Gard.
Forage—E. W. Rising.
Gates and Gatekeepers—Wm. Ball.
Police—John Sharp.

EXECUTIVE COMMITTEE MEETING.

Hibbard House, Jackson,
April 15, 1886.

The Executive Committee met on call of the President.

Roll called. Present: Pres't Chamberlain, Treas. Dean, Messrs. Rising, Hanford, Ball, Lessiter, Cobb, Hyde, Sharp, Burrington, Reed, Gard, Shoemaker, J. P., Wood, Turner, Howard, Angel, Wells, Young, Gilbert, Anderson, Shoemaker, M., Baxter, Webber, Humphrey, Fralick, Parsons, and the Secretary.

The Committee on Permanent Location reported that they had received proposals from Detroit, Kalamazoo, Lansing and Jackson, and that they had visited the places named. The several propositions were read as follows:

Kalamazoo offered to sell the National Park grounds (63 acres) with all buildings for $30,000.

Detroit offered to furnish 63 acres of ground on Woodward Ave. free of rent, and $15,000 in cash.

Lansing offered $10,000 in cash, the grounds and buildings of the Central Mich. Ag'l Society (about 60 acres) subject to a mortgage of $10,000.

Jackson offered the Jackson County Fair grounds and buildings, the grounds to be square with the exception of three lots and ground added to make 50 acres in all, and $10,000 in cash. They also offered several new sites of 60 acres and over and $10,000 in cash.

Dr. Mitchell of Jackson offered 57 acres of land with all necessary buildings and a half-mile track for a rental of $8,000 for the 1st year, $6,000 for the 2d $5,000 for the 3d, $4,000 for the 4th and each subsequent year.

Mr. Wood moved, and it was supported, that the Lansing proposition be accepted.

Mr. Baxter moved, as an amendment, to proceed to an informal ballot to determine the preference of the Committee.

After a lengthy discussion the amendment was carried. The first ballot resulted as follows: For Detroit 8, Jackson 9, Lansing 11. Total. 28.

Mr. Webster moved that the Temporary Locating Committee be instructed to proceed to locate the Fair for 1886.

Col. Shoemaker moved as an amendment that we proceed to another informal ballot.

The amendment carried and the 2d informal ballot stood as follows: For Detroit 4, for Jackson 11, for Lansing 12, blank 1. Total 28. Upon motion, the 3d informal ballot was taken resulting as follows: Detroit 2, Jackson 12, Lansing 14. Total 28. Mr. Gilbert moved, and it was supported, to proceed to a formal ballot for a location as between Jackson and Lansing.

The motion prevailed and the ballot resulted as follows: For Jackson 15, Lansing 12, blank 1. Total 28. On motion of Col. Shoemaker, it was

Resolved, That a vote of a majority of all the members of the Executive Committee in favor of any place shall be considered as the expression of the Committee in favor of a permanent location at that place provided satisfactory arrangements for railroad transportation and the detail of the lease or conveyance of the ground be made with the Committee of the Society.

Mr. Webster moved to proceed to vote for a permanent location; that the roll be called and each member state his choice when his name is called. The motion prevailed, the roll called and the vote was as follows:

For Lansing, Messrs. Rising, Lessiter, Ball, Cobb, Howard, Reed, Burrington, Turner, Wood, Angel, Wells, Webber, and Fralick,—13. For Jackson, Messrs. Sharp, Shoemaker M., Shoemaker J. P., Hyde, Gard, Young, Dean, Baxter, Humphrey, Parsons, Chamberlain, and Sterling—12.

For Detroit, Messrs. Hanford and Anderson—2.

Upon motion of Mr. Webber the Locating Committee was instructed to proceed to locate the Fair for 1886.

Mr. Fralick moved that the vote taken at the last meeting of the executive committee accepting an invitation to meet at the Agricultural College in June be reconsidered. Carried.

Mr. Fralick then moved that the invitation be not accepted. Carried.

On motion of Mr. Baxter, it was *Resolved*, that the Committee on Permanent Location be continued with power to receive propositions and make inquiries as to the best place for a permanent location of the Fair and that they report to this committee at any time hereafter with their recommendation on the subject.

On motion adjourned.

WM. CHAMBERLAIN, *Pres't.*

J. C. STERLING, *Sec.*

MEETING OF THE LOCATING COMMITTEE.

HURD HOUSE, JACKSON,
April 21, 1886.

The Locating Committee met at 2 o'clock P. M., pursuant to the call of the President.

Present, Prest. Chamberlain, Treasurer Dean, Messrs. Hyde, Sharp, Hanford, Cobb, Turner, Gilbert and Secretary.

Propositions were received from Kalamazoo and Jackson.

Mr. Eaton offered for Kalamazoo the use of the fair grounds and buildings and $1,000 in cash.

Mr. Amos Root, for Jackson, offered the fair grounds and buildings, in good order, to move and re-build the grand stand, and $2,000 in cash.

Mr. Turner moved that the Fair be held on the Jackson grounds, provided the Jackson people will remove all the Society's buildings from Kalamazoo and erect them on the Jackson grounds, grade and tile-drain the grounds, put all buildings now on the grounds in good repair, ready for the exhibition, the Jackson Society to own all the buildings.

Mr. Hyde moved, as an amendment, that the Fair for 1886 be held at Kalamazoo, provided the Kalamazoo people will put the grounds and buildings in order and give $1,250.

The amendment and motion were lost.

Mr. Gilbert offered an amended proposition, which was lost.

After some discussion the committee voted a recess till 7:30 P. M.

7:30 P. M.

The committee re-assembled at the appointed time.

The following named members of the committee were present:

Prest. Chamberlain, Treas. Dean, Messrs. Sharp, Hanford, Gilbert and Secretary.

The following proposition was received from Jackson, and accepted by a unanimous vote:

The Jackson citizens' committee agree to move all buildings and lumber belonging to the Society from the Kalamazoo grounds and erect the same on the Jackson fair grounds under the direction of the Business Committee; to transport all other property belonging to the Society at Kalamazoo to Jackson, and to put the buildings now on the Jackson grounds in good repair; to move and rebuild the grand stand, to square, fill, grade and tile-drain the grounds as contemplated by a resolution of the Common Council of the city of Jackson, furnish water free, and put in the water pipe necessary, the County Agricultural Society to own all buildings.

On motion the President was authorized to close contract with the citizens' committee in accordance with above proposition.

Motion to adjourn carried.

WM. CHAMBERLAIN, *Prest.*

J. C. STERLING, *Secretary.*

MINUTES OF MEETINGS DURING FAIR HELD SEPTEMBER 13—17, 1886.

HIBBARD HOUSE, JACKSON,
Monday, Sept. 13, 1886.

The Executive Committee met at 7:30 o'clock P. M.

President Chamberlain in the chair.

Present: Pres't Chamberlain, Treas. Dean, Messrs. Ball, Sharp, Hyde, Cobb, Butterfield, Rising, Lessiter, Shoemaker, J. P., Reed, Gard, Angel, Howard, Wood, Wells, Young, Baxter, Burrington, Fralick, Phillips, Parsons and the Secretary.

Supts. Phillips and Butterfield reported all stalls taken and more stock on the grounds unprovided for.

Supt. Lessiter asked for more swine pens.

Supts. Fralick, Baxter, Wells, Gard and Wood, reported roofs in their departments in very bad condition.

Several late entries were reported by the Sec'y.

It was moved and supported that all entries for Divisions A, B, C, D & E, received by mail after Sept. 1st and postmarked later than that date be rejected. Carried.

Moved and supported that the annual election be held on the Fair grounds in the building now occupied by the Sec'y of State. The motion prevailed and Messrs. W. L. Wilcox of Lenawee, H. O. Hilton of Van Buren, and Max Anderson, of Midland, were duly elected Judges of election.

On motion adjourned.

WM. CHAMBERLAIN, *President.*

J. C. STERLING, *Sec'y.*

HIBBARD HOUSE, JACKSON,
Tuesday, Sept. 14, 1886.

The Executive Committee met at 7:30 P. M.

President Chamberlain in the chair.

Roll called: Present, President Chamberlain, Treas. Dean, Messrs. Ball, Sharp, Hyde, Cobb, Rising, Butterfield, Lessiter, Reed, Shoemaker, J. P., Howard, Wood, Young, Gard, Angel, Hanford, Burrington, Anderson, Baxter, Parsons, Phillips, Fralick and Sec'y.

Supt. Butterfield reported that no more stalls had been provided for his department; a number of cattle were without shelter.

On motion Messrs. Sharp and Cobb were appointed a committee to provide stalls outside the grounds for horses, now occupying cattle stalls.

Mr. Butterfield moved, and it was supported, that all horses entered and kept outside the grounds be provided with admission tickets. Carried.

Treas. Dean reported gate receipts for Tuesday, $707.50.

Mr. Styles of the Jackson Ice Company asked that their teams be allowed to enter the grounds, to deliver ice, free.

Upon motion, the request was granted.

Adjourned.

Wm. CHAMBERLAIN, *President.*

J. C. STERLING, *Secretary.*

WEDNESDAY, Sept. 15, 1886.

The Committee met in the Hibbard House parlors at 7:30 P. M. President Chamberlain presiding.

Roll called: Quorum present.

Mr. W. P. Danow asked the privilege of entering his cattle for the Herd premium. Not granted.

Several protests were read and referred to Supt. of Horse Department.

A communication from the Michigan State Poultry and Pet Stock Association asking the Society to donate $25 to that Association, was read and on motion tabled.

Adjourned.

Wm. CHAMBERLAIN, *President.*

J. C. STERLING, *Secretary.*

MEETING OF THE SOCIETY.

WEDNESDAY, Sept. 15, 1886.

Pursuant to published notice, the annual caucus of the Society was held at the Hibbard House this evening. Mr. Wm. Chamberlain was chosen Chairman and J. C. Sterling Secretary.

It was moved and supported that the Chairman appoint a committee on nominations to consist of one member from each Congressional District or as nearly so as practicable. The motion prevailed and the Chairman named as such committee Messrs. H. O. Hanford, J. H. Field, Amos. Root, C. W. Young, Henry Fralick, Samuel Johnson, Charles Moore, M. P. Anderson, D. W. Howard, J. Q. A. Burrington, and G. A. Smith.

Recess thirty minutes.

Meeting called to order. The committee on nominations reported the following nominations :

For President—Wm. Chamberlain, Three Oaks.

For Treasurer—A. J. Dean, Adrian.

For Secretary—J. C. Sterling, Monroe.

For Members of the Executive Committee.—Wm. Ball, Hamburg, Livingston, County; Jno. C. Sharp, Jackson, Jackson County; A. O. Hyde, Marshall, Calhoun County; W. H. Cobb, Kalamazoo, Kalamazoo County; E. W. Rising, Davison Station, Genesee County; I. H. Butterfield, Lapeer, Lapeer County; John Lessiter, Jersey, Oakland County; James M. Turner, Lansing, Ingham County; J. P. Shoemaker, Amsden, Montcalm County; F. Hart Smith, Hillsdale County.

On motion, report accepted and adopted.

Meeting adjourned.

WM. CHAMBERLAIN, *Chairman.*

J. C. STERLING, *Secretary.*

HIBBARD HOUSE, JACKSON,
Thursday, September 16, 1886.

The Executive Committee met at 7:30 o'clock P. M., Prest. Chamberlain in the chair.

Quorum present.

The communication from the State Poultry and Pet Stock Association, tabled at last evening's meeting, was, on motion of Mr. Fralick, taken up.

A motion to donate $25.00 to the Association was lost.

A protest against Mr. Lockwood's stallion, entered in class 15, was read and referred to Supt. Phillips to report at winter meeting.

Supt. Phillips reported that he had investigated the charges entered against the team entered by Mr. Strong, and recommended that the protest be not sustained.

It was moved and supported that the protest against Mr. Strong's team be not sustained. Carried.

The report of the judges of election was then read as follows:

We, the judges of election at the annual election of officers of the Michigan State Agricultural Society, held at the fair grounds in the city of Jackson on the 16th day of September, 1886, do hereby certify that at such election the following named persons were duly elected officers of said Society, and that the following named were candidates at such election, and the number of votes were as follows cast for each:

Whole number of votes cast	378
For President, William Chamberlain received	378
For Treasurer, A. J. Dean received	378
For Secretary, J. C. Sterling received	378
For Members of the Executive Board:	
William Ball received	211
John C. Sharp received	373
A. O. Hyde received	378
W. H. Cobb received	378
E. W. Rising received	378
I. H. Butterfield received	378
John Lessiter received	378
James M. Turner received	378
J. P. Shoemaker received	378
F. Hart Smith received	371
Milton J. Gard received	175

The President, Treasurer and Secretary named, and the ten members of the Executive Committee first named, having received the highest number of votes cast were elected.

Signed,

ORRIN H. HILTON,
MAX ANDERSON,
S. E. GRAVES,
Judges of Election.

Report accepted and adopted.

On motion adjourned.

WM. CHAMBERLAIN, *Prest.*

J. C. STERLING, *Secretary.*

HIBBARD HOUSE, JACKSON,
Friday, September 17, 1886.

The Executive Committee met and was called to order by the President.

Roll called, quorum present.

Supt. Butterfield reported regular premiums awarded in Division A $3,253.00. The judges recommended a premium of $30.00 on a herd of Ayrshires. The Supt. recommended that the premium be awarded, making total awards in this department $3,283.00.

The report with recommendations accepted and adopted.

Supt. Phillips, of Division B, Horses, reported regular premiums awarded amounting to $3,310.00

Report accepted and adopted.

Supt. Howard, of Division C, Sheep, reported $1,451.00 awarded—all regular premiums.

Adopted.

Supt. Lessiter, of Division D, Swine, reported regular premiums awarded amounting to $646.00 in cash and five Diplomas.

Adopted.

Supt. Burrington, Division E, Poultry, reported regular awards in his department $291.00 and recommended discretionary premiums amounting to $21.00, total $312.00.

Accepted and adopted.

Supt. Wood, Division F, Farm and Garden products, reported regular premiums awarded amounting to $528.00.

Adopted.

Supt. Shoemaker, Division G, Dairy Products, reported regular premiums awarded amounting to $144.00 and recommended premiums on non-enumerated articles amounting to $5.00, total $149.00.

Report with recommendation adopted.

Supt. Gard, Division H, Bees and Honey, reported regular premiums awarded amounting to $296.00 and recommended discretionary premium of $1.00.

Report with recommendation adopted.

Supt. Young of Division I, Farm Implements, reported a large exhibit; no premiums offered or awarded.

Accepted.

Supt. Fralick, Division L, Manufacturers, reported regular premiums awarded amounting to $226.00 and recommended discretionary premiums amounting to $30.00; total $256.00.

Report with recommendations accepted and adopted.

Supt. Baxter of Division N, Art, reported regular premiums awarded as $766.00, premiums recommended on non-enumerated articles $23.00; total, $789.00.

Report with recommendations adopted.

Supt. Parsons, Division O, Needlework, reported regular premiums awarded in this department amounting to $219.00. Discretionary premiums recommended amounting to $27.50.

Report with recommendations of Supt. adopted.

Supt. Wells, Division P, Miscellaneous, reported regular premiums amounting to $34.00, discretionary recommended $46.00; total $80.00.

Report with recommendation of Supt. adopted.

Supt. Parson, Division Q, Children's Department, reported regular awards amounting to $8.00; no discretionary premiums.

Accepted and adopted.

Supt. Rising, of Forage, reported expense of his Department about $1,500.00.

Supt. Phillips reported that all protests referred to him Wednesday evening, had been withdrawn.

The following communication was received from the Secretary of State, accepted and placed on file:

HON. WM. CHAMBERLAIN,
President Michigan State Agricultural Society:

SIR:—I have the honor to report that this department has, during the fair, maintained an office in the building assigned it near the main entrance to the grounds.

The number of tickets received from Treas. Dean was		174
Number issued	154	
Number spoiled	2	
Number returned	18—	174

The courtesy of the Society in granting the Department complimentaries for its crop correspondents is highly appreciated, and I take pleasure in expressing to you, and through you to the Society, my own and the correspondents' thanks for the same.

Very respectfully,

HARRY A. CONANT,
Sec'y of State.

The following communication, signed by over forty exhibitors of cattle, was then read:

MICHIGAN STATE FAIR GROUNDS,
Jackson, Sept. 17, 1886.

We, the undersigned, exhibitors of cattle at the 38th Annual Michigan State Fair, desire to express our thanks to Mr. I. H. Butterfield, Supt., for his courteous treatment and good management under unfavorable circumstances, and request that he be retained in his present position.

Treasurer Dean reported total gate receipts for the week as $17,080.25.

Adjourned.

WM. CHAMBERLAIN, *Prest.*

J. C. STERLING, *Secretary.*

OFFICIAL LIST OF PREMIUMS AWARDED AT THE THIRTY-EIGHTH ANNUAL FAIR OF THE SOCIETY, HELD AT JACKSON, SEPT. 13 TO 17, 1886.

DIVISION A.—CATTLE.

CLASS 1.—SHORTHORNS.

Best bull, 4 years old or over, Trevith & Bowditch, Hillsdale, Mich	$20 00
2d do., W. E. Boyden, Delhi Mills	15 00
3d do., A. D. DeGarmo, Highland Station	10 00
Best bull, 3 years old, J. S. Flint, Somerset	20 00
2d do., Easterly Bros., Marshall	15 00
3d do., A. B. West, Columbiaville	10 00
Best bull, 2 years old, Frank Merritt, Charlotte	20 00
2d do., D. C. Reed, Kalamazoo	15 00
3d do., Frederick Warner, Dexter	10 00
Best bull, 1 year old, W. E. Boyden, Delhi Mills	15 00
2d do., J. S. Flint, Somerset	10 00
3d do., Jacob Gander, Adrian	5 00
Best bull calf, under 1 year, A. D. DeGarmo, Highland Station	12 00
2d do., Jas. Conley & Co., Marshall	8 00
3d do., W. E. Boyden, Delhi Mills	5 00
Best cow, 4 years old or over, A. D. DeGarmo, Highland Station	20 00
2d do., Agricultural College, Lansing	15 00
3d do., W. D. Boyden, Delhi Mills	10 00
Best cow, 3 years old, W. E. Boyden, Delhi Mills	20 00
2d do., Jacob Gander, Adrian	15 00
3d do., A. D. DeGarmo, Highland Station	10 00
Best heifer, 2 years old, W. E. Boyden, Delhi Mills	20 00
2d do., Jas. M. Turner, Lansing	15 00
3d do., Benj. F. Bachelor, Osceola Centre	10 00
Best yearling heifer, Chas. Blanchard, Morenci	15 00
2d do., W. E. Boyden, Delhi Mills	10 00
3d do., W. E. Boyden, Delhi Mills	5 00
Best heifer calf, under 1 year, Jas. Conley & Co., Marshall	12 00
2d do., W. E. Boyden, Delhi Mills	8 00
3d do., W. E. Boyden, Delhi Mills	5 00
Best aged herd of Shorthorns, W. E. Boyden, Delhi Mills	35 00
2d do., A. D. DeGarmo, Highland Station	25 00
3d do., Almond Hosner, North Farmington	20 00
Best young herd of Shorthorns, W. E. Boyden, Delhi Mills	20 00
2d do., A. D. DeGarmo, Highland Station	15 00
Best Shorthorn bull and four of his get, sweepstakes, Benj. F. Bachelor, Osceola Centre	20 00
2d do., Jacob Gander, Adrian	12 00
3d do., A. F. Wood, Mason	8 00

RICHARD GIBSON,
PELEG WINSLOW,
Judges.

CLASS 2—DEVONS.

Best bull four years old or over, E. T. Doney, Jackson	$20 00
Best bull three years old, E. T. Doney, Jackson	20 00
Best bull two years old, W. S. Walker, Utica	20 00
Best bull one year old, H. L. Carrier, Brookfield	15 00
2d do., H. W. Calkins, Allegan	10 00
3d do., E. T. Doney, Jackson	5 00
Best bull calf, W. S. Walker, Utica	12 00
2d do., W. H. Calkins, Allegan	8 00
Best cow four years old or over, W. S. Walker, Utica	20 00
2d do., W. H. Calkins, Allegan	15 00
3d do., E. T. Doney, Jackson	10 00
Best cow three years old, W. S. Walker, Utica	20 00
2d do., W. H. Calkins, Allegan	15 00
3d do., E. T. Doney, Jackson	10 00
Best heifer two years old, H. L. Carrier, Brookfield	20 00
2d do., W. S. Walker, Utica	15 00
3d do., H. L. Carrier, Brookfield	10 00
Best heifer one year old, W. S. Walker, Utica	15 00
2d do., E. T. Doney, Jackson	10 00
3d do., H. L. Carrier, Brookfield	5 00
Best heifer calf, E. T. Doney, Jackson	12 00
2d do., W. S. Walker, Utica	8 00
3d do., H. L. Carrier, Brookfield	3 00
Best herd of aged Devons, W. S. Walker, Utica	35 00
2d do., E. T. Doney, Jackson	25 00
3d do., H. W. Calkins, Allegan	20 00
Best young herd of Devons, W. S. Walker, Utica	20 00

W. J. G. DEAN,
Judge.

CLASS 3—HEREFORDS.

Best bull four years old or over, Wm. Hamilton, Flint	$20 00
2d do., Edwin Phelps, Pontiac	15 00
3d do., Edwin Driggs, Palmyra	10 00
Best bull three years old, Merrill & Fifield, Bay City	20 00
2d do., Wm. Hamilton, Flint	15 00
Best bull two years old, R. G. Hart, Lapeer	20 00
2d do., Edwin Phelps, Pontiac	15 00
3d do., Sotham & Stickney, Pontiac	10 00
Best bull one year old, Sotham & Stickney, Pontiac	15 00
2d do., Merrill & Fifield, Bay City	10 00
3d do., Merrill & Fifield, Bay City	5 00
Best bull under one year old, Edwin Phelps, Pontiac	12 00
2d do., Wm. Hamilton, Flint	8 00
3d do., Wm. Hamilton, Flint	5 00
Best cow, 4 years old or over, Merrill & Fifield, Bay City	20 00
2d do., Wm. Hamilton, Flint	15 00
3d do., Wm. Hamilton, Flint	10 00
Best cow, 3 years old, Merrill & Fifield, Bay City	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Edwin Phelps, Pontiac	10 00
Best heifer, 2 years old, Merrill & Fifield, Bay City	20 00
2d do., Merrill & Fifield, Bay City	15 00
3d do., Merrill & Fifield, Bay City	10 00
Best yearling heifer, Merrill & Fifield, Bay City	15 00
2d do., Wm. Hamilton, Flint	10 00
3d do., Wm. Hamilton, Flint	5 00
Best heifer calf under 1 year, Edwin Phelps, Pontiac	12 00
2d do., Wm. Hamilton, Flint	8 00
3d do., Merrill & Fifield, Bay City	5 00
Best aged herd of Herefords, Merrill & Fifield, Bay City	35 00
2d do., Wm. Hamilton, Flint	25 00
3d do., Sotham & Stickney, Pontiac	20 00

Best young herd of Herefords, Wm. Hamilton, Flint	$20 00
2d do., Edwin Phelps, Pontiac	15 00

J. O. CURRY,
Judge.

CLASS 4—JERSEYS.

Best bull, 4 years old or over, O. J. Bliss, Silver Creek	$25 00
2d do., E. B. & C. S. Smith, Eagle	15 00
3d do., W. J. Crawford, Jackson	10 00
Best bull, 3 years old, M. L. Frink, Oxford	20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., E. E. Bostwick, Union City	10 00
Best bull, 2 years old, W. J. G. Dean, Hanover	20 00
2d do., M. L. Frink, Oxford	15 00
3d do., E. O. Dewey, Owosso	10 00
Best bull, 1 year old, W. J. G. Dean, Hanover	15 00
2d do., H. R. Kingman, Battle Creek	10 00
3d do., E. B. & C. S. Smith, Eagle	5 00
Best bull calf, W. J. G. Dean, Hanover	12 00
2d do., O. J. Bliss, Silver Creek	8 00
3d do., H. R. Kingman, Battle Creek	5 00
Best cow, 4 years old or over, E. B. & C. S. Smith, Eagle	20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., W. J. G. Dean, Hanover	10 00
Best cow, 3 years old, W. J. G. Dean, Hanover	20 00
2d do., H. R. Kingman, Battle Creek	15 00
3d do., W. J. G. Dean, Hanover	10 00
Best heifer, 2 years old, H. R. Kingman, Battle Creek	20 00
2d do., O. J. Bliss, Silver Creek	15 00
3d do., Anderson Bros., Midland	10 00
Best heifer, 1 year old, H. R. Kingman, Battle Creek	15 00
2d do., E. B. & C. S. Smith, Eagle	10 00
3d do., Mrs. N. B. Sherman, Cooper	5 00
Best heifer calf, Hiram Walker & Son, Detroit	12 00
2d do., M. L. Frink, Oxford	8 00
3d do., W. J. G. Dean, Hanover	5 00
Best aged herd of Jerseys, H. R. Kingman, Battle Creek	35 00
2d do., E. B. & C. S. Smith, Eagle	25 00
3d do., O. J. Bliss, Silver Creek	20 00
Best young herd of Jerseys, H. R. Kingman, Battle Creek	20 00
2d do., E. B. & C. S. Smith, Eagle	15 00
Best Jersey bull and four of his get, W. J. G. Dean, Hanover	20 00
2d do., O. J. Bliss, Silver Creek	12 00
3d do., E. B. & C. S. Smith, Eagle	8 00

JOHN D. SUMNER,
F. W. GRINNELL,
J. A. MANN,
Judges.

CLASS 5—GALLOWAYS AND POLLED ANGUS.

Best bull, 4 years old or over, R. B. Caruss, St. Johns	$20 00
2d do., W. P. Darrow, Jefferson	15 00
3d do., C. W. & H. P. Tubbs, Kalamo	10 00
Best bull, 3 years old, Hiram Walker & Son, Detroit	20 00
2d do., S. J. Murphey, Detroit	15 00
Best bull, 2 years old, Wm. Keith, Pittsford	20 00
Best bull, 1 year old, S. J. Murphey, Detroit	15 00
2d do., S. J. Murphey, Detroit	10 00
3d do., C. W. & H. P. Tubbs, Kalamo	5 00
Best bull calf, S. J. Murphey, Detroit	12 00
2d do., S. J. Murphey, Detroit	8 00
3d do., C. W. & H. P. Tubbs, Kalamo	5 00
Best cow, 4 years old or over, R. B. Caruss, St. Johns	20 00
2d do., S. J. Murphey, Detroit	15 00
3d do., W. P. Darrow, Jefferson	10 00

Best cow, 3 years old, W. P. Darrow, Jefferson	$20 00
2d do., R. B. Caruss, St. Johns	15 00
3d do., W. P. Darrow, Jefferson	10 00
Best heifer, 2 years old, R. G. Hart, Lapeer	20 00
2d do., W. P. Darrow, Jefferson	15 00
3d do., S. J. Murphey, Detroit	10 00
Best heifer, 1 year old, R. B. Caruss, St. Johns	15 00
2d do., W. P. Darrow, Jefferson	10 00
Best heifer calf, S. J. Murphey, Detroit	12 00
2d do., S. J. Murphey, Detroit	8 00
3d do., R. B. Caruss, St. Johns	5 00
Best aged herd of Galloways or Polled Angus, R. B. Caruss, St. Johns	35 00

SAMUEL JOHNSON,
Judge.

CLASS 6.—HOLSTEIN-FRIESIAN.

Best bull, four years old or over, C. V. Seeley, N. Farmington	$20 00
2d do., Stone & Biggs, Hastings	15 00
3d do., Wm. A. Rowley, Mt. Clemens	10 00
Best bull, 3 years old, Wm. K. Sexton, Howell	20 00
2d do., O. S. Chapel, Parma	15 00
3d do., Tousey & Seeley, Pontiac	10 00
Best bull, two years old, W. L. Simmons, Northville	20 00
2d do., Badgley & Bissell, Jackson	15 00
3d do., Wm. K. Sexton, Howell	10 00
Best bull, one year old, M. R. Seeley & Co., Farmington	15 00
2d do., W. K. Sexton, Howell	10 00
3d do., Olds & Bacon, York	5 00
Best bull calf, under one year old, Jno. W. W. Harris, Pinckney	12 00
2d do., C. V. Seeley, N. Farmington	8 00
3d do., Wm. A. Rowley, Mt. Clemens	5 00
Best cow, four years old or over, Wm. A. Rowley, Mt. Clemens	20 00
2d do., Wm. A. Rowley, Mt. Clemens	15 00
3d do., Tousey & Seeley, Pontiac	10 00
Best cow, three years old, M. R. Seeley & Co., Farmington	20 00
2d do., W. K. Sexton, Howell	15 00
3d do., Tousey & Seeley, Pontiac	10 00
Best heifer, two years old, C. V. Seeley, N. Farmington	20 00
2d do., Tousey & Seeley, Pontiac	15 00
3d do., Badgley & Bissell, Jackson	10 00
Best yearling heifer, J. W. Salliard, Romeo	15 00
2d do., Badgley & Bissell, Jackson	10 00
3d do., Wm. A. Rowley, Mt. Clemens	5 00
Best heifer calf, one year old, Wm. A. Rowley, Mt. Clemens	12 00
2d do., C. V. Seeley, N. Farmington	8 00
3d do., C. V. Seeley, N. Farmington	5 00
Best aged herd of Holstein-Friesians, Wm. A. Rowley, Mt. Clemens	35 00
2d do., C. V. Seeley, N. Farmington	25 00
3d do., W. K. Sexton, Howell	20 00
Best young herd of Holstein-Friesians, J. W. Salliard, Romeo	20 00
2d do., Albert Riley, Walled Lake	15 00
Best Holstein-Fresian bull and four of his get, bred in Michigan, C. V. Seeley, N. Farmington	20 00
2d do., W. A. Rowley, Mt. Clemens	12 00
3d do., W. K. Sexton, Howell	8 00

L. C. PAYNE,
Judge.

CLASS 7—GRADE CATTLE.

Best cow, four years old or over, David Miller, Clarkston	$20 00
2d do., A. P. Cook, Brooklyn	15 00
3d do., W E. Boyden, Delhi Mills	10 00
Best cow, three years old, David Miller, Clarkston	20 00
Best heifer, two years old, A. Hosner, N. Farmington	20 00
2d do., A. P. Cook, Brooklyn	15 00
3d do., David Miller, Clarkston	10 00

Best heifer, one year old, A. Hosner, N. Farmington	$15 00
2d do., J. M. Turner, Lansing	10 00
3d do., F. A. Townley, Tompkins	5 00
Best heifer calf, A. P. Cook, Brooklyn	12 00
2d do., David Miller, Clarkston	8 00
3d do., John W. Harris, Pinckney	5 00

J. S. FLINT,
A. D. DeGARMO,
A. J. WINDIATE,
Judges.

CLASS 8.—FAT CATTLE.

Best steer, three years old and under four, A. Hosner, N. Farmington	$20 00
2d do., F. A. Townley, Tompkins	15 00
Best steer, two years old and under three, Jas. A. Conley & Co., Marshall	20 00
2d do., F. A. Townley, Tompkins	15 00
3d do., A. Hosner, N. Farmington	10 00
Best steer, one year old and under two, A. Hosner, N. Farmington	15 00
2d do., C. S. Blanchard, Morenci	10 00
3d do., A. Hosner, N. Farmington	5 00
Best steer calf, six months old and under one year, F. A. Townley, Tompkins	15 00
Best herd of fat cattle, A. Hosner, N. Farmington	30 00
2d do., F. A. Townley, Tompkins	20 00

Best steer three years old and under four, showing greatest weight for age in days, with cost, etc., A. Hosner, N. Farmington, $15. Age, 1,146 days; weight, 1,760 lbs; average gain per day, 1.536 lbs.

Best steer two years old and under three, showing greatest weight for age in days, with cost, etc., F. A. Townley, Tompkins, $15. Age, 826 days; weight, 1,560 lbs; average gain per day, 1.888; calved June 13, 1884; ran with dam seven months; cost, $10; fed corn and meal, 300 lbs., next five months, cost $3; hay and pasture, $5: meal consumed from one to two years old, 1,460 lbs., cost $14.60; hay and pasture from one to two years old, $12; meal consumed from June 13 to Sept. 13, 1886, 500 lbs., $5; hay and pasture from June 13 to Sept. 13, 1886, $4; total cost, $53.60.

Best steer one year old and under two, showing greatest weight for age in days, with cost, etc., C. S. Blanchard, Morenci, $15. Age, 539 days; weight, 1,280 lbs; average gain per day, 2.37 lbs.

Herd of Ayrshires, discretionary premium, Alexander Edmonds, Hastings, $30.

HENRY LESSITER,
DAVID MILLER,
H. WOODMAN,
Judges.

DIVISION B—HORSES.

CLASS 9—CLEVELAND BAYS.

Best stallion, 4 years old or over, T. A. King & Son, Parma	$20 00
2d do., Henry Haynes, Jackson	15 00
Best stallion, 3 years old, C. S. Truesdell, Wayne	20 00
2d do., High & Droellie, Grass Lake	15 00

S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 10—THOROUGHBREDS.

Best stallion, 4 years old or over, W. R. Walker, Athens	$20 00
2d do., Chas. P. Hatch, Pontiac	15 00
Best stallion, 3 years old, Peter H. Hagle, Pontiac	20 00
2d do., E. Harwood, Leslie	15 00
Best stallion, 2 years old, John W. Turner, Matteson	12 00
Best stallion, 1 year old, Charles Burnham, Fulton	10 00

Best stallion colt, Peter H. Hagle, Pontiac	$7 00
2d do., J. W. Hicks, Horton	5 00
Best brood mare, 4 years old or over, with foal, Chas. Burnham, Fulton	20 00
2d do., Peter H. Hagle, Pontiac	15 00
Best brood mare, 4 years old or over, without foal, Thomas B. True, Leslie	15 00
Best brood mare, 2 years old, Charles Burnham, Fulton	10 00
Best filly colt, Charles Burnham, Fulton	6 00

H. F. PHELPS,
S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 11—HORSES OF ALL WORK.

Best stallion, 4 years old or over, R. G. Johnson, Jerome	$20 00
2d do., George Mason, Maple Grove	15 00
3d do., Knapp & Avery, Grand Rapids	10 00
Best stallion, 3 years old, Edward R. Hann, Parma	20 00
2d do., C. C. Chapel, Parma	15 00
3d do., James M. Turner, Lansing	10 00
Best stallion, 2 years old, George W. Phillips, Jr., Romeo	12 00
2d do., J. W. Haines, Eaton Rapids	10 00
3d do., David Chapel, Parma	8 00
Best stallion, 1 year old, S. P. Riffenberg, Jones' Crossing	10 00
2d do., N. E. Burghduff, Coldwater	8 00
3d do., J. E. Belden, Horton	5 00
Best stallion colt, Jacob Geigu, Springport	8 00
2d do., J. J. Palmer, Liberty	5 00
3d do., Charles Allen, Parma	3 00
Best brood mare, 4 years old or over, foal by side, Cleveland Bay Horse Co., Paw Paw	20 00
2d do., George W. Phillips, Jr., Romeo	15 00
3d do., Charles A. Davis, Albion	10 00
Best mare, 4 years old or over, without foal, Charles A. Davis, Albion	12 00
2d do., Wm. R. Walker, Athens	8 00
3d do., D. C. Blair, Napoleon	5 00
Best mare, 3 years old, George W. Phillips, Jr., Romeo	10 00
2d do., Robert Gould & Son, Ceresco	8 00
3d do., T. Spicer & Son, Charlotte	4 00
Best mare, 2 years old, Thomas Maxwell, Lawton	8 00
2d do., Will N. Adams, Jackson	5 00
3d do., D. Chapel, Parma	3 00
Best mare, 1 year old, J. J. Palmer, Liberty	7 00
2d do., J. J. Palmer, Liberty	5 00
3d do., O. B. Hosner, Hope	3 00
Best filly colt, Cleveland Bay Horse Co., Paw Paw	5 00
2d do., Will N. Adams, Jackson	3 00
3d do., George W. Phillips, Jr., Romeo	2 00
Best gelding, 5 years old or over, James C. Deyo, Jackson	15 00
2d do., John Powers, Homer	10 00
3d do., Frank Davenport & Co., Grass Lake	5 00
Best gelding, 4 years old, Frank Davenport & Co., Grass Lake	12 00
Best gelding, 3 years old, Eli Stephenson, Jackson	10 00
2d do., Piper & Wilber, Concord	8 00
3d do., T. Spicer & Son, Charlotte	5 00
Best gelding, 2 years old, Will N. Adams, Jackson	8 00
2d do., Frank Davenport & Co., Grass Lake	5 00
3d do., Charles A. Davis, Albion	3 00
Best gelding, 1 year old, A. H. Shurtz, Batavia	6 00
2d do., Charles A. Davis, Albion	4 00
3d do., Robert Gould & Son, Ceresco	2 00
Best pair of matched horses of all work, 5 years old or over, A. H. Murray, Parma	30 00
2d do., Phineas Farrow, Lawton	20 00
3d do., W. S. Peacock, Leslie	10 00

Best pair 4-year-old horses, matched, Frank Davenport & Co., Grass Lake	$25 00
Best pair of matched horses for all work, 3 years old, Thomas Maxwell, Lawton	15 00

A. W. COYKENDALL,
B. F. PROCTOR,
JAMES DAVIDSON,
Judges.

CLASS 12—ROADSTERS.

Best stallion, 5 years old or over, 3d, Henry Darrow, Homer	$10 00
Best stallion, 4 years old, W. H. Cowham, Jackson	20 00
2d do., Henry Brown, Battle Creek	15 00
3d do., M. H. Ray, Concord	10 00
Best stallion, 3 years old, W. H. Schautz, Hastings	20 00
2d do., John Shurtz, Bronson	15 00
3d do., A. L. Smith, Girard	10 00
Best gelding, 5 years old or over, Eugene Russell, Jackson	15 00
2d do., D. N. Tripp, Coldwater	10 00
3d do., James C. Deyo, Jackson	5 00
Best gelding four years old, Robert Gould & Son, Ceresco	12 00
2d do., Melvin Osborne, Homer	8 00
Best gelding three years old, James C. Deyo, Jackson	10 00
2d do., Lewis Straw, Concord	6 00
3d do., James Welch, Somerset	4 00
Best mare four years old or over, without colt, C. A. Durand, Jackson	12 00
2d do., N. G. Davis, Jackson	8 00
3d do., W. A. Cowham, Jackson	5 00
Best mare three years old, James C. Deyo, Jackson	10 00

S. A. COLBY,
J. W. PARKHURST,
H. F. PHILLIPS,
Judges.

CLASS 13—BREEDERS' STOCK.

Best stallion two years old, C. C. Pond, Jackson	$12 00
2d do., H. Richfield, Jackson	8 00
3d do., E. E. Brewster, Horton	5 00
Best stallion one year old, Thomas Hungerford, Concord	10 00
2d do., C. C. Hill, Battle Creek	6 00
3d do., D. C. Blair, Napoleon	4 00
Best stallion colt, Robert Gould & Son, Ceresco	7 00
2d do., A. J. C. Post & Son, Wasepi	5 00
3d do., W. A. Higgins, Jackson	3 00
Best gelding two years old, Charles L. Blanchard, Morenci	8 00
Best gelding one year old, Robert Gould & Son, Ceresco	6 00
Best brood mare four years old or over, with foal by side, Robert Gould & Son, Ceresco	20 00
2d do., W. A. Higgins, Jackson	15 00
3d do., A. J. C. Post & Son, Wasepi	10 00
Best mare two years old, W. N. Adams, Jackson	8 00
2d do., W. H. Saunderson & Co., Hanover	5 00
3d do., C. R. Durand, Jackson	3 00
Best mare one year old, D. B. Hibbard, Jackson	7 00
2d do., Farrell & Godfrey, Parma	5 00
3d do., Levi Straw, Concord	2 00
Best mare colt, W. A. Gibson, Jackson	5 00

R. W. COYKENDALL,
B. F. PROCTOR,
JAMES DAVIDSON,
Judges.

CLASS 14—GENTS' DRIVING HORSES TO ROAD WAGONS.

Best pair of driving horses not kept for sporting purposes, James C. Deyo, Jackson	$25 00
2d do., V. K. Brown, Salt River	20 00
Best single mare or gelding five years old or over, A. E. Sutton, Jackson	25 00
2d do., C. C. Pond, Jackson	20 00
3d do., A. J. Barber, Mason	10 00
Best single mare or gelding four years old or over, Wm. Thompson, Jackson	20 00
2d do., H. M. Williams, Mason	15 00
3d do., A. G. Gale, Albion	10 00

S. A. COLBY,
J. W. PARKHURST,
H. F. PHILLIPS,
Judges.

CLASS 15—CLYDESDALE AND ENGLISH DRAFT HORSES.

Best stallion four years old or over, C. E. Lockwood, Washington (protested)	$25 00
2d do., James M. Turner, Lansing	20 00
3d do., Farrell & Godfrey, Parma	10 00
Best stallion three years old, A. B. West, Columbiaville	20 00
2d do., C. B. Truesdell, Wayne	12 00
Best stallion two years old, C. E. Lockwood, Washington	10 00
2d do., James M. Turner, Lansing	6 00
Best stallion one year old, E G. Rust, Saginaw	8 00
Best stallion colt, James M. Turner, Lansing	5 00
Best brood mare four years old or over, James M. Turner, Lansing	20 00
2d do., James M. Turner, Lansing	12 00
3d do., James M. Turner, Lansing	8 00
Best mare or gelding two years old, James M. Turner, Lansing	10 00

R. W. COYKENDALL,
B. F. PROCTOR,
J. W. PARKHURST,
Judges.

CLASS 16—NORMAN PERCHERON AND OTHER FRENCH DRAFT HORSES.

Best stallion four years old or over, T. Philip, Hastings	$25 00
2d do., Savage & Farnum, Detroit	20 00
3d do., Eli Bachtel, Hastings	10 00
Best stallion three years old, Savage & Farnum, Detroit	20 00
2d do., R. G. Hart, Lapeer	12 00
3d do., Savage & Farnum, Detroit	8 00
Best stallion two years old, Savage & Farnum, Detroit	10 00
2d do., Savage & Farnum, Detroit	6 00
3d do., T. W. Palmer, Detroit	4 00
Best stallion one year old, Savage & Farnum, Detroit	8 00
Best stallion colt, T. W. Palmer, Detroit	5 00
Best mare four years old or over, Savage & Farnum, Detroit	20 00
2d do., Savage & Farnum Detroit	12 00
3d do., Savage & Farnum, Detroit	8 00
Best mare three years old, T. W. Palmer, Detroit	12 00
Best mare or gelding two years old, T. W. Palmer, Detroit	10 00
2d do., T. W. Palmer, Detroit	6 00
3d do., Savage & Farnum, Detroit	4 00
Best mare one year old, T. W. Palmer, Detroit	8 00
3d do., T. W. Palmer, Detroit	3 00
Best filly colt, T. W. Palmer, Detroit	5 00

R. W. COYKENDALL,
B. F. PROCTOR,
Judges.

CLASS 17—DRAFT HORSES.

Best pair mares or geldings, 4 years old or over, G. T. Smith Purifier Co., Jackson	$25 00
2d do., Sheldon & Co., Jackson	20 00
3d do., G. T. Smith Purifier Co., Jackson	10 00
Best pair mares or geldings, 3 years old, J. Woodbeck, Armada	20 00
Best mare, 4 years old or over, James M. Turner, Lansing	20 00
2d do., James M. Turner, Lansing	12 00
3d do., James M. Turner, Lansing	8 00
Best mare, 3 years old, James M. Turner, Lansing	12 00
Best mare or gelding, 2 years old, C. E. Lockwood, Washington	10 00
2d do., C. E. Lockwood, Washington	6 00
3d do., George W. M. Shearer, Jackson	4 00
Best mare, 1 year old, O. Hulett, Romeo	8 00
2d do., C. E. Lockwood, Washington	5 00
3d do., C. E. Lockwood, Washington	3 00
Best filly colt, James M. Turner, Lansing	5 00
2d do., James M. Turner, Lansing	3 00
3d do., James M. Turner, Lansing	2 00

S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 18—CARRIAGE AND BUGGY HORSES.

Best pair matched carriage horses, 16 hands or over, 5 years old or over, Frank Davenport & Co., Grass Lake	$25 00
2d do., W. L. Peacock, Leslie	20 00
Best pair matched carriage horses, under 16 hands, 4 years old or over, R. E. Strong, Jackson	25 00
2d do., J. C. Deyo, Jackson	15 00
3d do., S. Cooley, Romeo	10 00
Best pair matched carriage horses, 3 years old, R. Gould & Son, Ceresco	20 00
2d do., O. B. Hosner, Hope	12 00
Best single carriage horse or mare, 4 years old or over, J. C. Deyo, Jackson	12 00
2d do., W. R. Wellington, Springport	8 00
3d do., J. O. Hewitt, Jackson	4 00
Best single carriage horse, 3 years old, W. R. Wellington, Springport	10 00
2d do., W. J. Bissell, Leslie	7 00
3d do., J. C. Deyo, Jackson	3 00

S. A. COLBY,
J. W. PARKHURST,
H. F. PHILLIPS,
Judges.

CLASS 19—ROADSTER STALLIONS, STANDARD BRED.

Best stallion, 5 years old, A. S. Perrin, Parkville	$100 00
2d do., G. N. Hatch, Horton	75 00
3d do., W. J. Drake, Corunna	50 00
Best stallion, 4 years old, A. J. Barber, Mason	75 00
2d do., W. A. Gibson, Jackson	50 00
3d do., W. N. Grimes, Schoolcraft	25 00
Best stallion, 3 years old, John Shurtz, Bronson	30 00
2d do., W. J. Bissell, Leslie	20 00
3d do., J. C. Deyo, Jackson	10 00
Best stallion, 2 years old, Griswold Brothers, Vermontville	20 00
2d do., Ray Warner, Coldwater	15 00
3d do., Piper & Wilber, Concord	10 00

J. W. PARKHURST,
H. F. PHILLIPS,
S. A. COLBY,
Judges.

CLASS 20—ROADSTER MARES AND GELDINGS, STANDARD BRED.

Best mare or gelding, 5 years old or over, C. C. Pond, Jackson	$100 00
2d do., F. A. Granger, Tekonsha	75 00
3d do., W. H. Cowham, Jackson	50 00
Best mare or gelding, 4 years old, Nixon Brothers, Cassopolis	75 00
2d do., W. J. Bauer, Jackson	50 00
3d do., W. A. Gibson, Jackson	25 00
Best mare or gelding, 3 years old, Ray Warner, Coldwater	30 00
2d do., D. B. Hibbard, Jackson	20 00
3d do., John Shurtz, Bronson	10 00
Best mare or gelding, 2 years old, Ray Warner, Coldwater	20 00
2d do., Griswold Brothers, Vermontville	15 00

J. W. PARKHURST,
S. A. COLBY,
H. F. PHILLIPS,
Judges.

CLASS 21—THOROUGHBRED STALLIONS, MARES AND GELDINGS.

Best stallion, any age, Mrs. Josie L. Ames, Charlotte	$75 00
2d do., E. C. Remington, Fentonville	50 00
Best mare or gelding, any age, George W. Quick, Saginaw City	50 00
2d do., Louis Brockway, Saginaw City	30 00
3d do., P. B. Baker, Jerome	20 00

J. W. PARKHURST,
S. A. COLBY,
JAMES DAVIDSON,
Judges.

CLASS 22—SWEEPSTAKES FOR STALLION WITH SIX COLTS OF HIS GET.

Best thoroughbred stallion, W. R. Walker, Athens	$25 00
2d do., C. P. Hatch, Horton	20 00
Best all-work stallion, Charles A. Davis, Albion	25 00
2d do., Milton Reed, Jackson	20 00
Best roadster stallion, W. A. Gibson, Jackson	25 00
2d do., D. B. Hibbard, Jackson	20 00
Best draft stallion, E. C. Lockwood, Washington	25 00
2d do., Farrell & Godfrey, Parma	20 00

H. F. PHILLIPS,
S. A. COLBY,
Judges.

DIVISION C—SHEEP.

CLASS 23—THOROUGHBRED AMERICAN MERINOS.

Best ram three years old or over, Van Gieson Brothers, Clinton	$15 00
2d do., C. M. Thorrington, Northville	12 00
3d do., A. A. Wood, Saline	8 00
Best ram two years old, Wm. and E. N. Ball, Hamburg	15 00
2d do., Wm. and E. N. Ball, Hamburg	12 00
3d do., C. A. Wood, Napoleon	8 00
Best ram one year old, A. A. Wood, Saline	15 00
2d do., E. J. & E. W. Hardy, Osceola Centre	12 00
3d do., E. J. & E. W. Hardy, Osceola Centre	8 00
Best ram lamb, Benjamin Batcheler, Osceola Centre	12 00
2d do., W. & E. N. Ball, Hamburg	10 00
3d do., L. C. Nelson, Olivet	5 00
Best two ewes three years old or over, C. A. Wood, Napoleon	15 00
2d do., A. A. Wood, Saline	12 00
3d do., John Chilson, Hanover	8 00

Best two ewes two years old, A. A. Wood, Saline	$15 00
2d do., E. Kellogg, Osceola Centre	12 00
3d do., Van Gieson Brothers, Clinton	8 00
Best two ewes one year old, W. & E. N. Ball, Hamburg	15 00
2d do., A. A. Wood, Saline	12 00
3d do., O. F. Pease, Grass Lake	8 00
Best two ewe lambs, W. G. Smith, Olivet	12 00
2d do., W. & E. N. Ball, Hamburg	10 00
3d do., A. A. Wood, Saline	5 00

S. C. LOMBARD,
JAMES W. NEWBERRY,
Judges.

CLASS 24—THOROUGHBRED AMERICAN MERINOS, BRED IN MICHIGAN.

Best ram two years old or over, A. A. Wood, Saline	$15 00
2d do., C. M. Fellows, Manchester	12 00
3d do., L. W. & O. Barnes, Byron	8 00
Best ram one year old, A. A. Wood, Saline	15 00
2d do., E. Kellogg, Osceola Centre	12 00
3d do., C. M. Fellows, Manchester	8 00
Best ram lamb, A. A. Wood, Saline	12 00
2d do., W. & E. N. Ball, Hamburg	10 00
3d do., E. Kellogg, Osceola Centre	5 00
Best two ewes two years old or over, F. C. Wood, Saline	15 00
2d do., Van Gieson Brothers, Clinton	12 00
3d do., E. Kellogg, Osceola Centre	8 00
Best two ewes one year old, A. A. Wood, Saline	15 00
2d do., Van Gieson Brothers, Clinton	12 00
3d do., Wm. & E. N. Ball, Hamburg	8 00
Best two ewe lambs, A. A. Wood, Saline	12 00
2d do., Wm. & E. N. Ball, Hamburg	10 00
3d do., C. M. Fellows, Manchester	5 00

JAMES W. NEWBERRY,
S. C. LOMBARD,
Judges.

CLASS 25—FINE WOOL GRADES.

Best two ewes three years old or over, C. M. Thornton, Northville	$10 00
2d do., Allen & Brown, Springport	6 00
3d do., Nelson Brewer, Dutton	4 00
Best two ewes two years old, Nelson Brewer, Dutton	10 00
2d do., L. W. & O. Barnes, Byron	6 00
3d do., Nelson Brewer, Dutton	4 00
Best two ewes one year old, Nelson Brewer, Dutton	10 00
2d do., Allen & Brown, Springport	6 00
3d do., W. C. Weeks, Napoleon	4 00
Best two ewe lambs, Nelson Brewer, Dutton	10 00
2d do., L. W. & O. Barnes, Byron	5 00
3d do., C. W. Weeks, Napoleon	3 00

C. M. FELLOWS,
S. S. FARRINGTON,
J. M. KRESS,
Judges.

CLASS 26—SOUTHDOWNS.

Best ram two years old or over, A. B. West, Columbiaville	$15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., A. B. West, Columbiaville	6 00
Best ram one year old, J. F. Rundel, Birmingham	12 00
2d do., A. B. West, Columbiaville	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., R. Conley, Marshall	6 00
3d do., A. B. West, Columbiaville	4 00

Best two ewes two years old or over, John Lessiter, Jersey	$15 00
2d do., A. B. West, Columbiaville	10 00
3d do., A. B. West, Columbiaville	6 00
Best two ewes one year old, Mrs. Ann Newton, Pontiac	12 00
2d do., R. Conley, Marshall	8 00
3d do., A. B. West, Columbiaville	5 00
Best two ewe lambs, Mrs. Ann Newton, Pontiac	10 00
2d do., A. B. West, Columbiaville	6 00
3d do., A. B. West, Columbiaville	4 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 27—ALL MIDDLE-WOOL SHEEP OTHER THAN SOUTHDOWNS.

Best ram two years old or over, J. F. Rundel, Birmingham	$15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., W. B. Mason, Marshall	6 00
Best ram one year old, J. F. Rundel, Birmingham	12 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best ram lamb, Mrs. Ann Newton, Pontiac	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., G. Longmuir, Pontiac	4 00
Best two ewes, 2 years old or over, J. F. Rundel, Birmingham	15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., L. S. Dunham, Concord	6 00
Best two ewes, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., G. Longmuir, Pontiac	5 00
Best two ewe lambs, G. Longmuir, Pontiac	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., J. L. Eggleston & Son, Parma	4 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 28—ALL MIDDLE-WOOL SHEEP OTHER THAN SOUTHDOWNS, BRED IN MICHIGAN.

Best ram, 2 years old or over, Frank Willson, Jackson	$15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., A. B. West, Columbiaville	6 00
Best ram, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., Mrs. Ann Newton, Pontiac	8 00
3d do., G. Longmuir, Pontiac	5 00
Best ram lamb, M. B. Armstrong, N. Farmington	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00
Best two ewes, 2 years old or over, J. F. Rundel, Birmingham	15 00
2d do., G. Longmuir, Pontiac	10 00
3d do., John Lessiter, Jersey	6 00
Best two ewes, 1 year old, J. F. Rundel, Birmingham	12 00
2d do., John Lessiter, Jersey	8 00
3d do., G. Longmuir, Pontiac	5 00
Best two ewe lambs, M. B. Armstrong, N. Farmington	10 00
2d do., J. F. Rundel, Birmingham	6 00
3d do., G. Longmuir, Pontiac	4 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 29—LEICESTERS.

Best ram, 2 years old or over, A. F. Wood, Mason	$15 00
2d do., Robt. Knight, Marlette	10 00
3d do., Mrs. Ann Newton, Pontiac	6 00

Best ram, 1 year old, Mrs. Ann Newton, Pontiac	$12 00
2d do., A. F. Wood, Mason	8 00
Best ram lamb, Robt. Knight, Marlette	10 00
2d do., Robt. Knight, Marlette	6 00
3d do., Mrs. Ann Newton, Pontiac	4 00
Best two ewes, 2 years old or over, A. F. Wood, Mason	15 00
2d do., A. F. Wood, Mason	10 00
Best two ewes, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., Robt. Knight, Marlette	8 00
3d do., A. F. Wood, Mason	5 00
Best two ewe lambs, Robt. Knight, Marlette	10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
3d do., A. F. Wood, Mason	4 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 30—COTSWOLD AND OTHER LONG-WOOLED SHEEP.

Best ram, 2 years old or over, Montgomery & Westfall, Hillsdale	$15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., Frank Willson, Jackson	6 00
Best ram, 1 year old, Montgomery & Westfall, Hillsdale	12 00
2d do., F. Spicer & Son, Charlotte	8 00
3d do., Sotham & Stickney, Pontiac	5 00
Best ram lamb, Frank Willson, Jackson	10 00
2d do., Montgomery & Westfall, Hillsdale	6 00
3d do., Frank Willson, Jackson	4 00
Best two ewes, 2 years old or over, L. S. Dunham, Concord	15 00
2d do., Mrs. Ann Newton, Pontiac	10 00
3d do., Montgomery & Westfall, Hillsdale	6 00
Best two ewes, 1 year old, Mrs. Ann Newton, Pontiac	12 00
2d do., Sotham & Stickney, Pontiac	8 00
3d do., Sotham & Stickney, Pontiac	5 00
Best two ewe lambs, Frank Willson, Jackson	10 00
2d do., Montgomery & Westfall, Hillsdale	6 00
3d do., Montgomery & Westfall, Hillsdale	4 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 31—GRADE COARSE-WOOLED EWES.

Best two ewes, 2 years old or over, Montgomery & Westfall, Hillsdale	$10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
Best two ewes, 1 year old, Montgomery & Westfall, Hillsdale	10 00
2d do., Mrs. Ann Newton, Pontiac	6 00
Best two ewe lambs, Mrs. Ann Newton, Pontiac	8 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

CLASS 32—FAT SHEEP.

Best two middle-wool sheep, 2 years old and under 3, Mrs. Ann Newton, Pontiac	$10 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., G. Longmuir, Pontiac	5 00
Best two middle-wool sheep, 1 year old and under 2, J. F. Rundel, Birmingham	10 00
2d do., John Lessiter, Jersey	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best two long-wooled sheep, 2 years old and under 3, Mrs. Ann Newton, Pontiac	10 00
2d do., Montgomery & Westfall, Hillsdale	8 00
Best two long-wooled sheep, 1 year old and under 2, Mrs. Ann Newton, Pontiac	10 00
2d do., Montgomery & Westfall, Hillsdale	8 00

Best two grade sheep two years old and under three, J. F. Rundel, Birmingham	$10 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., Mrs. Ann Newton, Pontiac	5 00
Best two grade sheep one year old and under two, J. F. Rundel, Birmingham	10 00
2d do., J. F. Rundel, Birmingham	8 00
3d do., C. L. Blanchard, Morenci	5 00

GOODWIN HOWARD,
A. WINCHESTER,
Judges.

DIVISION D—SWINE.

CLASS 33—BERKSHIRES.

Best boar two years old or over, C. Hibbard & Son, Bennington	$12 00
Best boar one year old, C. Hibbard & Son, Bennington	10 00
Best boar under one year old, C. Hibbard & Son, Bennington	8 00
Best brood sow two years old or over, C. Hibbard & Son, Bennington	12 00
Best sow one year old, C. Hibbard & Son, Bennington	10 00
Best sow under one year old, C. Hibbard & Son, Bennington	8 00
Best pen of pigs, C. Hibbard & Son, Bennington	8 00
Best boar, any age, C. Hibbard & Son, Bennington	Diploma

F. W. GRINNELL,
Judge.

ESSEX.

Best boar two years old or over, Frank Willson, Jackson	$12 00
2d do., A. Chandler, Jerome	8 00
3d do., E. T. Doney, Jackson	4 00
Best boar one year old, Frank Willson, Jackson	10 00
2d do., F. A. Ray, Concord	6 00
3d do., E. T. Doney, Jackson	3 00
Best boar under one year old, Frank Willson, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., W. A. Higgins, Jackson	3 00
Best brood sow two years old or over, A. Chandler, Jerome	12 00
2d do., W. A. Higgins, Jackson	8 00
3d do., Frank Willson, Jackson	4 00
Best sow one year old, Frank Willson, Jackson	10 00
2d do., E. T. Doney, Jackson	6 00
3d do., A. Chandler, Jerome	3 00
Best sow under one year old, Frank Willson, Jackson	8 00
2d do., W. A. Higgins, Jackson	5 00
3d do., A. Chandler, Jerome	3 00
Best pen of pigs, W. A. Higgins, Jackson	8 00
2d do., Frank Willson, Jackson	5 00
3d do., F. A. Ray, Concord	3 00
Best boar any age, Frank Willson, Jackson	Diploma

F. W. GRINNELL,
Judge.

SUFFOLKS AND SMALL YORKSHIRES.

Best boar two years old or over, Frank Willson, Jackson	$12 00
2d do., A. Ganson, Fentonville	8 00
3d do., E. Driggs, Palmyra	4 00
Best boar one year old, Frank Willson, Jackson	10 00
2d do., H. M. Hilbert, North Lansing	6 00
Best boar under one year old, Frank Willson, Jackson	8 00
2d do., A. Ganson, Fentonville	5 00
3d do., H. M. Hilbert, North Lansing	3 00
Best brood sow two years old or over, H. M. Hilbert, North Lansing	12 00
2d do., Frank Willson, Jackson	8 00
3d do., A. Ganson, Fentonville	4 00
Best sow one year old, Frank Willson, Jackson	10 00
2d do., A. Ganson, Fentonville	00
3d do., E. Driggs, Palmyra	3 00

Best sow under one year old, Frank Willson, Jackson	$8 00
2d do., Frank Willson, Jackson	5 00
3d do., Mrs. Ann Newton, Pontiac	3 00
Best pen of pigs, A. Ganson, Fentonville	8 00
2d do., Frank Willson, Jackson	5 00
3d do., H. M. Hilbert, North Lansing	3 00
Best boar any age, Frank Willson, Jackson	Diploma

F. W. GRINNELL.
Judge.

POLAND CHINAS.

Best boar two years old or over, L. W. and O. Barnes, Byron	$12 00
2d do., H. M. Morse, Union City	8 00
3d do., L. W. & O. Barnes, Byron	4 00
Best boar one year old, C. A. Limbeck, Dowagiac	10 00
2d do., H. M. Morse, Union City	6 00
3d do., L. W. & O. Barnes, Byron	3 00
Best boar under one year, C. A. Limbeck, Dowagiac	8 00
2d do., H. W. Riley & Co., Greenville	5 00
3d do., G. F. Harrington, Paw Paw	3 00
Best brood sow two years old or over, L. W. & O. Barnes, Byron	12 00
2d do., W. H. Ashley, Homer	8 00
3d do., H. M. Morse, Union City	4 00
Best sow one year old, L. W. & O. Barnes, Byron	10 00
2d do., E. C. Rouse, Homer	6 00
3d do., E. C. Rouse, Homer	3 00
Best sow under one year old, C. A. Limbeck, Dowagiac	8 00
2d do., R. C. Morris, Decatur	5 00
3d do., G. F. Harrington, Paw Paw	3 00
Best pen of pigs, G. F. Harrington, Paw Paw	8 00
2d do., W. H. Ashley, Homer	5 00
3d do., C. A. Limbeck, Dowagiac	3 00
Best boar of any age, L. W. &. O. Barnes, Byron	Diploma

F. W. GRINNELL,
Judge.

CHESTER WHITES AND OTHER LARGE BREEDS NOT ENUMERATED.

Best boar two years old or over, C. A. Searing, Lyons	$12 00
Best boar one year old, C. A. Searing, Lyons	10 00
2d do., Joseph Lindsey, Otsego	6 00
3d do., Joseph Lindsey, Otsego	3 00
Best boar under one year old, C. A. Searing, Lyons	8 00
2d do., M. H. Walworth, Hillsdale	5 00
3d do., C. A. Searing, Lyons	3 00
Best brood sow two years old or over, Milton Reed, Jackson	12 00
2d do., C. A. Searing, Lyons	8 00
3d do., James McBride, Burton	4 00
Best sow one year old, Joseph Lindsey, Otsego	10 00
2d do., Joseph Lindsey, Otsego	6 00
3d do., Joseph Lindsey, Otsego	3 00
Best sow under one year old, Joseph Lindsey, Otsego	8 00
2d do., Joseph Lindsey, Otsego	5 00
3d do., M. H. Walworth, Hillsdale	3 00
Best pen of pigs, C. A. Searing, Lyons	8 00
2d do., Joseph Lindsey, Otsego	5 00
3d do , M. H. Walworth, Hillsdale	3 00
Best boar any age, C. A. Searing, Lyons	Diploma

F. W. GRINNELL,
Judge.

FAT HOGS.

Best barrow or sow over one year old, W. A. Higgins, Jackson	$10 00
2d do., Frank Willson, Jackson	6 00
3d do., E. T. Doney, Jackson	3 00

Best barrow or sow less than one year old, Frank Willson, Jackson	$6 00
2d do., Frank Willson, Jackson	4 00
3d do., E. T. Doney, Jackson	2 00

F. W. GRINNELL,
Judge.

DIVISION E—POULTRY.

CLASS 34.

Best collection of Asiatic fowls and chickens, James Ball, Marshall	$10 00
2d do., D. R. McElwain, Hastings	5 00
Best pair light Brahma fowls, H. F. Ford & Co., Hastings	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair light Brahma chicks, A. G. Weston, Unadilla	2 00
2d do., Joseph Lindsey, Otsego	1 00
Best pair dark Brahma fowls, Jas. Ball, Marshall	2 00
2d do., H. F. Ford & Co., Hastings	1 00
Best pair dark Brahma chicks, James Ball, Marshall	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair buff Cochin fowls, James Ball, Marshall	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair buff Cochin chicks, H. M. Watson, Okemos	2 00
2d do., James Ball, Marshall	1 00
Best pair partridge or grouse Cochin fowls, D. R. McElwain, Hastings	2 00
2d do., James Ball, Marshall	1 00
Best pair partridge or grouse Cochin chicks, James Ball, Marshall	2 00
2d do., James Ball, Marshall	1 00
Best pair white Cochin fowls, James Ball, Marshall	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair white Cochin chicks, M. H. Walworth, Hillsdale	2 00
2d do., James Ball, Marshall	1 00
Best pair black Cochin fowls, James Ball, Marshall	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair black Cochin chicks, James Ball, Marshall	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair Leghorn fowls, Z. A. Hartsuff, Unadilla	2 00
2d do., James Ball, Marshall	1 00
Best pair Leghorn chicks, Joseph Lindsay, Otsego	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair Plymouth Rock fowls, C. L. Hogue, Battle Creek	2 00
2d do., Dyer Bros., Jackson	1 00
Best pair Plymouth Rock chicks, C. L. Hogue, Battle Creek	2 00
2d do., Benj. F. Batcheler, Osceola Center	1 00
Best pair Wyandotte fowls, C. L. Hogue, Battle Creek	2 00
2d do., C. L. Hogue, Battle Creek	1 00
Best pair Wyandotte chicks, C. L. Hogue, Battle Creek	2 00
2d do., C. L. Hogue, Battle Creek	1 00
Best pair black-breasted red game bantam fowls, M. C. Woodmansee, Hastings	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair black-breasted red game bantam chicks, H. F. Ford & Co., Hastings	2 00
2d do., H. M. Watson, Okemos	1 00
Best pair duck-wing game bantam fowls, D. R. McElwain, Hastings	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair duck-wing game bantam chicks, Ambrose Purchase, Freeland	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair white bantam fowls, A. G. Weston, Unadilla	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair white bantam chicks, H. M. Watson, Okemos	2 00
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair golden-laced Sebright bantam fowls, Z. A. Hartsuff, Unadilla	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair golden-laced Sebright bantam chicks, D. R. McElwain, Hastings	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair black African bantam fowls, McDonald Bros., Marshall	2 00
Best pair black African bantam chicks, McDonald Bros., Hastings	2 00
2d do., McDonald Bros., Marshall	1 00

Best pair colored Dorking chicks, M. H. Walworth, Hillsdale	$2 00
2d do., M. H. Walworth, Hillsdale	1 00
Best pair Dominique fowls, D. R. McElwain, Hastings	2 00
2d do., M. H. Walworth, Hillsdale	1 00
Best pair Dominique chicks, M. H. Walworth, Hillsdale	2 00
2d do., M. H. Walworth, Hillsdale	1 00
Best pair Houdan fowls, A. G. Weston, Unadilla	2 00
2d do., D. R. McElwain, Unadilla	1 00
Best pair Houdan chicks, A. G. Weston, Unadilla	2 00
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair black-breasted red game fowls, Dyer Bros., Jackson	2 00
2d do., B. J. Dolph, Albion	1 00
Best pair black-breasted red game chicks, B. J. Dolph, Albion	2 00
2d do., B. J. Dolph, Albion	1 00
Best pair duck-wing game fowls, H. F. Ford & Co., Hastings	2 00
2d do., Jno. M. Bird, Ann Arbor	1 00
Best pair duck-wing game chicks, Jno. M. Bird, Ann Arbor	2 00
Best pair Pile game fowls, D. R. McElwain, Hastings	2 00
2d do., Jno. M. Bird, Ann Arbor	1 00
Best pair Pile game chicks, J. Lewis, Marengo	2 00
2d do., Jno. M. Bird, Ann Arbor	2 00
Best pair golden-spangled Hamburg fowls, H. M. Watson, Okemos	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair golden-spangled Hamburg chicks, M. H. Walworth, Hillsdale	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair silver-spangled Hamburg fowls, M. H. Walworth, Hillsdale	2 00
2d do., M. H. Walworth, Hillsdale	1 00
Best pair silver-spangled Hamburg chicks, M. H. Walworth, Hillsdale	2 00
Best pair golden-penciled Hamburg fowls, M. C. Woodmansee, Hastings	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair golden-penciled Hamburg chicks, D. R. McElwain, Hastings	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair silver-penciled Hamburg fowls, H. F. Ford & Co., Hastings	2 00
Best pair silver-penciled Hamburg chicks, H. F. Ford & Co., Hastings	2 00
Best pair black Hamburg fowls, D. R. McElwain, Hastings	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair black Hamburg chicks, D. R. McElwain, Hastings	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair black Polish fowls, Z. A. Hartsuff, Unadilla	2 00
Best pair black Polish chicks, Jas. Ball, Marshall	2 00
Best pair white Polish fowls, Ambrose Purchase, Freeland	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair silver Polish fowls, H. M. Watson, Okemos	2 00
2d do., Jas. Ball, Marshall	1 00
Best pair silver Polish chicks, D. R. McElwain, Hastings	2 00
2d do., Jas. Ball, Marshall	1 00
Best pair golden Polish fowls, Jas. Ball, Marshall	2 00
2d do., Jno. M. Bird, Ann Arbor	1 00
Best pair golden Polish chicks, Jas. Ball, Marshall	2 00
2d do., Jas. Ball, Marshall	1 00
Best pair black Spanish fowls, H. M. Watson, Okemos	2 00
2d do., Ed. Driggs, Palmyra	1 00
Best pair black Spanish chicks, Z. A. Hartsuff, Unadilla	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair white Leghorn fowls, Ambrose Purchase, Freeland	2 00
2d do., Ed. Driggs, Palmyra	1 00
Best pair white Leghorn chicks, Ambrose Purchase, Freeland	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair brown Leghorn fowls, C. L. Hogue, Battle Creek	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair brown Leghorn chicks, Z. A. Hartsuff, Unadilla	2 00
2d do., J. Lewis, Marengo	1 00
Best pair black Leghorn fowls, M. C. Woodmansee, Hastings	2 00
2d do., H. F. Ford & Co., Hastings	1 00
Best pair black Leghorn chicks, Ambrose Purchase, Freeland	2 00
2d do., H. F. Ford & Co., Hastings	1 00

Best pair Rowen ducks, H. M. Watson, Okemos	$2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair Aylesbury ducks, D. R. McElwain, Hastings	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair Cayuga ducks, Ambrose Purchase, Freeland	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair topknot ducks, Ambrose Purchase, Freeland	2 00
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair Muskovy ducks, Z. A. Hartsuff, Unadilla	2 00
2d do., John M. Bird, Ann Arbor	1 00
Best pair Pekin ducks, H. M. Watson, Okemos	2 00
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair Toulouse geese, H. M. Watson, Okemos	2 00
2d do., M. C. Woodmansee, Hastings	1 00
Best pair brown Chinese geese, Z. A. Hartsuff, Unadilla	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair Embden geese, Ambrose Purchase, Freeland	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair white Chinese geese, Ambrose Purchase, Freeland	2 00
2d do., D. R. McElwain, Hastings	1 00
Best pair bronze turkeys, Z. A. Hartsuff, Unadilla	2 00
2d do., C. M. Fellows, Manchester	1 00
Best pair white turkeys, H. F. Ford & Co., Hastings	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair buff turkeys, Ambrose Purchase, Freeland	2 00
2d do., H. F. Ford & Co., Hastings	1 00
Best pair of grey turkeys, Ambrose Purchase, Freeland	2 00
Best pair of slate turkeys, Ambrose Purchase, Freeland	2 00
2d do., H. F. Ford & Co., Hastings	1 00
Best pair black turkeys, H. F. Ford & Co., Hastings	2 00
2d do, D. R. McElwain, Hastings	1 00
Best pair pea-fowls, D. R. McElwain, Hastings	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair pearl Guinea fowls, Ambrose Purchase, Freeland	2 00
2d do., Z. A. Hartsuff, Unadilla	1 00
Best pair white Guinea fowls, Z. A. Hartsuff, Unadilla	2 00
2d do., Ambrose Purchase, Freeland	1 00
Best pair canary birds, Z. A. Hartsuff, Unadilla	2 00
Best collection of stuffed birds, Carleton Gilbert, Jackson	10 00
2d do., G. W. Chambers, Jackson	5 00
Best buck lop-eared rabbit, John M. Bird, Ann Arbor	2 00
Best doe lop-eared rabbit, John M. Bird, Ann Arbor	2 00
Best pair white silk-haired rabbits, John M. Bird, Ann Arbor	2 00
Best pair common rabbits, Ambrose Purchase, Freeland	2 00
Best pair Guinea pigs, John M. Bird, Ann Arbor	2 00
Best show white mice, Ambrose Purchase, Freeland	2 00
Best show European dormice, Ambrose Purchase, Freeland	2 00
Best specimen of squirrels, Ambrose Purchase, Freeland	2 00
Best pair of ferrets, Z. A. Hartsuff, Unadilla	2 00

NON-ENUMERATED.

Pair black Java fowls, A. G. Weston, Unadilla	2 00
Pair black Java chicks, H. F. Ford & Co., Hastings	2 00
Pair white Leghorns, rose-combed, A. G. Weston, Unadilla	2 00
Pair frizzled fowls, H. M. Watson, Okemos	2 00
Pair partridge Cochin, pea-combed, D. R. McElwain, Hastings	2 00
Pair black Java chicks, H. F. Ford & Co., Hastings	2 00
Pair red Pile game bantam fowls, H. F. Ford & Co., Hastings	2 00
Pair Pile game bantams, D. R. McElwain, Hastings	2 00
Pair frizzled chicks, Ambrose Purchase, Freeland	2 00

DAVID JONES,
Judge.

DIVISION F—FARM AND GARDEN PRODUCTS.

CLASS 35—GRAINS AND SEEDS.

Best bushel red winter wheat, F. L. Reed, Olivet	$6 00
2d do., C. A. Searing, Lyons	4 00
Best bushel white winter wheat, D. Woodman, Paw Paw	6 00
2d do., Whipps Bros., Marion, Ohio	4 00
Best bushel oats, Whipps Bros., Marion, Ohio	3 00
2d do., Frank Willson, Jackson	2 00
Best 12 ears yellow Dent corn, C. Lazelle, Napoleon	2 00
2d do., Whipps Bros. Marion, Ohio	1 00
Best 12 ears white Dent corn, C. Lazelle, Napoleon	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best 12 ears any variety Dent corn, C. Lazelle, Napoleon	2 00
2d do., C. Lazelle, Napoleon	1 00
Best 12 ears yellow flint corn, 12-rowed, C. Lazelle, Napoleon	2 00
Best 12 ears yellow flint corn, 8-rowed, H. Tanner, Jackson	2 00
2d do., C. Lazelle, Napoleon	1 00
Best 12 ears red flint corn, blazed, J. M. Snyder, Jackson	2 00
2d do., W. F. Miller, Mason	1 00
Best 12 ears white flint corn, blazed, C. Lazelle, Napoleon	2 00
2d do., J. H. Phillips, Jackson	1 00
Best 12 ears sweet corn, early, Whipps Bros., Marion, Ohio	2 00
2d do., W. F. Miller, Mason	1 00
Best 12 ears sweet corn, late, D. H. Ranney, Jackson	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best 12 ears popcorn, Mrs. L. McClary, Galesburg	2 00
2d do., J. H. Phillips, Jackson	1 00
Best bushel rye, Whipps Bros., Marion, Ohio	3 00
2d do., Frank Willson, Jackson	2 00
Best bushel four-rowed barley, Whipps Bros., Marion, Ohio	3 00
2d do., D. Woodman, Paw Paw	2 00
Best bushel large clover seed, R. M. Cross, Ovid	3 00
2d do., Whipps Bros., Marion, Ohio	2 00
Best bushel small clover seed, John F. Drew, Jackson	3 00
2d do., J. M. Snyder, Jackson	2 00
Best bushel timothy seed, Whipps Bros., Marion, Ohio	3 00
2d do., Frank Willson, Jackson	2 00
Best bushel buckwheat, Whipps Bros., Marion, Ohio	3 00
2d do., D. B. Harrington, Mason	2 00
Best bushel flaxseed, Whipps Bros., Marion, Ohio	3 00
Best bushel of red-top grass seed, Whipps Bros., Marion, Ohio	3 00
Best bushel blue grass seed, Whipps Bros., Marion, Ohio	3 00
Best bushel Hungarian grass seed, Whipps Bros., Marion, Ohio	3 00
Best bushel millett, Whipps Bros., Marion, Ohio	3 00
Best bushel peas, Frank Willson, Jackson	3 00
Best bushel white beans, J. M. Blowers, Lawrence	3 00
2d do., F. M. Ellison, Jackson	2 00
Best display of a general assortment of seeds for field crops, D. Woodman, Paw Paw	10 00
Best display of the several kinds of grasses in heads, D. Woodman, Paw Paw	10 00
2d do., A. W. Jewett, Mason	5 00
Best display of corn in the ear, D. Woodman, Paw Paw	10 00
2d do., C. Lazelle, Napoleon	5 00
Best display of the several kinds of grasses in stalk and head, D. Woodman, Paw Paw	10 00
2d do., Whipps Bros., Marion, Ohio	5 00

T. H. LYONS,
Judge.

CLASS 36—ROOTS AND VEGETABLES.

Best peck Early Rose potatoes, Whipps Bros., Marion, Ohio	$2 00
2d do., H. Wixom, Mason	1 00
Best peck Early Vermont potatoes, D. B. Harrington, Mason	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best peck Early Ohio potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., E. A. Elliot, Jackson	1 00
Best peck Early Beauty of Hebron, Whipps Bros., Marion, Ohio	2 00
2d do., Mrs. J. H. Corning, Henrietta	1 00
Best peck Ontario potatoes, D. B. Harrington, Mason	2 00
2d do., W. F. Miller, Mason	1 00
Best peck Late Rose potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., H. Wixom, Mason	1 00
Best peck White Elephant potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., W. F. Miller, Mason	1 00
Best peck Granger potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., D. B. Harrington, Mason	1 00
Best peck Burbank potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., Wm. Blackmore, Jackson	1 00
Best peck Mammoth Pearl potatoes, D. B. Harrington, Mason	2 00
2d do., Whipps Bros., Marion Ohio	1 00
Best peck White Star potatoes, M. Harmon, Jackson	2 00
2d do., H. M. Watson, Okemos	1 00
Best peck Belle potatoes, D. B. Harrington, Mason	2 00
2d do., W. F. Miller, Mason	1 00
Best peck Late Beauty of Hebron potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., W. F. Miller, Mason	1 00
Best peck Snowflake potatoes, Whipps Bros., Marion, Ohio	2 00
2d do., D. B. Harrington, Mason	1 00
Best peck sweet potatoes, Whipps Bros., Marion, Ohio	3 00
2d do., W. S. Mason, Hanover	1 00
Best six blood beets, Whipps Bros., Marion, Ohio	2 00
Best six turnip beets, H. Wixom, Mason	2 00
2d do., C. H. Roberts, Ypsilanti	1 00
Best six sugar beets, E. B. Cochran, Parma	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best six white or yellow beets, W. F. Miller, Mason	2 00
2d do., O. B. Hosner, Hope	1 00
Best six beets for table use, M. Harmon, Jackson	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best six mangel wurtzels, J. B. Blakely, Jackson	2 00
2d do., O. B. Hosner, Hope	1 00
Best six orange carrots, Whipps Bros., Marion, Ohio	2 00
2d do., E. B. Cochran, Parma	1 00
Best six white carrots, F. Willson, Jackson	2 00
2d do., W. F. Miller, Mason	1 00
Best six any other variety of carrots, W. F. Miller, Mason	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best six flat turnips, Whipps Bros., Marion, Ohio	2 00
2d do., W. S. Mason, Hanover	1 00
Best six Swede turnips, Whipps Bros., Marion, Ohio	1 00
Best six any other variety turnips, Whipps Bros., Marion, Ohio	1 00
Best six parsnips, E. B. Cochran, Parma	2 00
2d do., H. Wixom, Mason	1 00
Best six salsify, Whipps Bros., Marion, Ohio	2 00
2d do., T. B. Lord, Comstock	1 00
Best six winter radishes, Whipps Bros., Marion, Ohio	2 00
Best six summer radishes, H. Purdy, Summit	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best and greatest variety of culinary vegetables, Whipps Bros, Marion, Ohio	2 00
Best four heads drumhead cabbage, H. Wixom, Mason	2 00
2d do., C. B. Roberts, Ypsilanti	1 00
Best four heads cone-head cabbage, C. B. Robertson, Ypsilanti	2 00
2d do., P. B. Pierce, Jackson	1 00
Best four heads red cabbage, T. B. Lord, Comstock	2 00
Best four heads cauliflower, M. Harmon, Jackson	2 00

Best dozen stems celery, M. Harmon, Jackson	$2 00
2d do., M. Waterbury, Ionia	1 00
Best dozen stems rhubarb, H. Purdy, Summit	2 00
Best six vegetable eggs, Whipps Bros., Marion, Ohio	2 00
Best dozen peppers, Whipps Bros., Marion, Ohio	2 00
2d do., C. B. Buckley, Leoni	1 00
Best peck any variety tomatoes, M. Harmon, Jackson	2 00
2d do., W. F. Miller, Mason	1 00
Best peck white onions, Whipps Bros., Marion, Ohio	2 00
2d do., H. Wixom, Mason	1 00
Best peck red onions, Whipps Bros., Marion, Ohio	2 00
2d do., J. H. McLien, Jackson	1 00
Best peck yellow onions, J. H. Corning, Henrietta	2 00
2d do., M. Harmon, Jackson	1 00
Best five summer squashes, Mrs. P. B. Pierce, Jackson	2 00
2d do., C. Lazelle, Napoleon	1 00
Best five marrow squashes, Whipps Bros., Marion, Ohio	2 00
Best five Hubbard squashes, Wm. Randel, Jackson	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best two sweet pumpkins, C. Lazelle, Napoleon	2 00
Best two field pumpkins, Whipps Bros., Marion, Ohio	2 00
Best three watermelons, A. D. Quick, Jackson	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best three muskmelons, Whipps Bros., Marion, Ohio	2 00
2d do., A. D. Quick, Jackson	1 00
Best three nutmeg melons, A. D. Quick, Jackson	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best three citrons, P. S. Ray, Norvell	2 00
Best five cucumbers, W. S. Mason, Hanover	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best half peck garden peas, Whipps Bros., Marion, Ohio	2 00
2d do., E. B. Cochran, Parma	1 00
Best half peck Lima beans, Whipps Bros., Marion, Ohio	2 00
2d do., M. Harmon, Jackson	1 00
Best half peck bush beans, Whipps Bros., Marion, Ohio	2 00
2d do., E. B. Cochran, Parma	1 00
Best half peck wax beans, A. W. Jewett, Mason	2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best six heads sunflower, C. H. Roberts, Ypsilanti	1 00
2d do., O. B. Hosner, Hope	1 00
Best six stems kohl rabi, H. Wixom, Mason	2 00

L. H. BAILEY, Jr.,
Judge.

CLASS 37—DISPLAY OF ROOTS AND VEGETABLES BY PROFESSIONAL GARDENERS.

Best display roots and vegetables, C. M. Hubbell, Ypsilanti	$60 00
2d do., H. Marx, Detroit	40 00
3d do., J. W. Davis, Jackson	20 00
Best display of potatoes, D. B. Harrington, Mason	25 00
2d do., A. W. Jewett, Mason	15 00

The Agricultural College had a very fine display of grain, seeds and vegetables that added much to the exhibition in this department.

L. H. BAILEY, Jr.,
Judge.

CLASS 38—FLOUR, MEAL AND FEED.

Best white wheat flour, Eldred Milling Co., Jackson	$ 3 00
2d do., T. B. Taylor, Jackson	2 00
Best red wheat flour, Eldred Milling Co., Jackson	3 00
2d do., C. H. Fauble, Waterford	2 00
Best sample bolted meal, Whipps Bros., Marion, Ohio	2 00
2d do., T. B. Taylor, Jackson	1 00
Best sample cornmeal, Whipps Bros., Marion, Ohio	2 00
3d do., T. B. Taylor, Jackson	1 00

Best sample ground feed, T. B. Taylor, Jackson	$2 00
2d do., Whipps Bros., Marion, Ohio	1 00
Best sample buckwheat flour, Whipps Bros., Marion, Ohio	2 00
2d do., T. B. Taylor, Jackson	1 00
Best sample rye flour, Whipps Bros., Marion, Ohio	2 00
Best sample Graham flour, Whipps Bros., Marion, Ohio	2 00
2d do., T. B. Taylor, Jackson	1 00
Best sample oatmeal, Whipps Bros., Marion, Ohio	2 00
Best display of flour, meal and feed, Eldred Milling Co., Jackson	5 00
2d do., T. B. Taylor, Jackson	3 00

O. B. CRANE,
Judge.

DIVISION G—DAIRY AND OTHER PRODUCTS.

CLASS 39—BUTTER, CHEESE AND DAIRY ARTICLES.

Best 25 pounds domestic butter, Mrs. J. Fellows, Jackson	$15 00
2d do., Mrs. E. Harwood, Leslie	12 00
3d do., E. Swift, Grass Lake	8 00
Best 50 pounds creamery butter, Walter Bordwell, Olivet	15 00
Best display of cheese, Walter Bordwell, Olivet	20 00
2d do., Walter Bordwell, Olivet	15 00

C. P. BAKER,
MRS. ALICE WING,
MRS. ELLEN PYNCHON,
Judges.

CLASS 40—SUGAR, BREAD AND PICKLES.

Best 10 pounds maple sugar, J. M. Blowers, Lawrence	$5 00
2d do., G. M. Davenport & Co., Woodland	3 00
Best gallon maple syrup, F. M. Benham, Mendon	3 00
2d do., L. A. Atwater, Hopkins	2 00
Best 5 gallons sorghum syrup, Mrs. A. J. Cowing, Henrietta	5 00
Best 3 loaves bakers' bread, J. A. Sheeley, Jackson	3 00
Best 3 loaves milk or self-raising bread, M. E. Bartlett, Jackson	3 00
2d do., Miss A. Kelley, Jackson	2 00
Best 3 loaves soda-raising bread, M. E. Bartlett, Jackson	3 00
2d do., Mrs. Lucy McCleary, Galesburg	1 00
Best 3 loaves yeast bread, M. E. Bartlett, Jackson	3 00
2d do., Mrs. S. McGary, Jackson	1 00
Best corn bread, Miss Minnie R. De Puy, Jackson	3 00
2d do., Mrs. N. D. Crawford, Jackson	2 00
Best 3 loaves brown bread, Mrs. S. McGary, Jackson	3 00
2d do., M. E. Bartlett, Jackson	2 00
Best sample flour bread, made by girl 16 or under, M. E. Bartlett, Jackson	3 00
2d do., Mrs. Purvis, Jackson	2 00
Best sample brown bread, made by girl under 16 years, M. E. Bartlett, Jackson	2 00
Best display of pickled vegetables, Miss Lillie Moore, Flint	5 00
2d do., Miss Nellie S. Nabors, Flint	3 00

NON-ENUMERATED.

Display table sauce, Nellie S. Nabors, Flint	$1 00
Meat pie, Mrs. A. Marshall, Parma	1 00
Plum pudding, Mrs. A. Marshall, Parma	1 00
Sample flour bread, Ethel Spencer, Jackson	1 00
Salt-raising Graham bread, J. D. Cook, Jackson	1 00

C. P. BAKER,
MISS ALICE WING,
MRS. ELLEN PYNCHON,
Judges.

DIVISION H—HONEY, BEES, ETC.

CLASS 42—BEES, HONEY AND APIARIAN IMPLEMENTS.

Best colony black bees, E. Hutchinson, Rogersville	$10 00
2d do., W. D. Higdon, Jackson	5 00
Best colony Italian bees, W. Z. Hutchinson, Rogersville	10 00
2d do., A. D. D. Wood, Rives Junction	5 00
Best colony Syrian bees, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best colony Carnolian bees, E. Hutchinson, Rogersville	10 00
2d do., H. D. Cutting, Clinton	5 00
Best display of full colonies of different races of bees, W. Z. Hutchinson, Rogersville	10 00
2d do., H. D. Cutting, Clinton	5 00
Best specimen comb honey, H. D. Cutting, Clinton	10 00
2d do., E. Hutchinson, Rogersville	5 00
Best display comb honey, W. Z. Hutchinson, Rogersville	20 00
2d do., H. D. Cutting, Clinton	10 00
Best specimen extracted honey, W. Z. Hutchinson, Rogersville	8 00
2d do., H. D. Cutting, Clinton	4 00
Best display extracted honey, H. D. Cutting, Clinton	12 00
2d do., W. Z. Hutchinson, Rogersville	6 00
Best display comb honey by a lady, Anna R. Cutting, Clinton	10 00
Best 10 pounds beeswax, Jno. A. Shelley, Jackson	5 00
2d do., W. Z. Hutchinson, Rogersville	3 00
Best bee feeder, W. Z. Hutchinson, Rogersville	2 00
2d do., H. D. Cutting, Clinton	1 00
Best bee smoker, W. Z. Hutchinson, Rogersville	2 00
2d do., H. D. Cutting, Clinton	1 00
Best bee hive for all purposes, W. Z. Hutchinson, Rogersville	5 00
2d do., A. D. D. Wood, Rives Junction	3 00
Best comb foundation machine, H. D. Cutting, Clinton	8 00
2d do., A. D. D. Wood, Rives Junction	4 00
Best comb foundation made on the grounds, A. D. D. Wood, Rives Junction	5 00
2d do., H. D. Cutting, Clinton	3 00
Best specimen comb foundation, H. D. Cutting, Clinton	4 00
2d do., A. D. D. Wood, Rives Junction	2 00
Best honey extractor, A. D. D. Wood, Rives Junction	5 00
2d do., H. D. Cutting, Clinton	3 00
Best honey knife, O. A. Quick, Leoni	2 00
2d do., D. D. Higdon, Jackson	1 00
Best machine for making holes in frames for wiring, H. D. Cutting, Clinton	2 00
Best queen cage for introducing queens, O. A. Quick, Leoni	2 00
2d do., W. Z. Hutchinson, Rogersville	1 00
Best queen cage for shipping, H. D. Cutting, Clinton	2 00
2d do., W. Z. Hutchinson, Rogersville	1 00
Best section box for comb honey, A. D. D. Wood, Rives Junction	2 00
2d do., H. D. Cutting, Clinton	1 00
Best wax extractor, W. Z. Hutchinson, Rogersville	3 00
2d do., H. D. Cutting, Clinton	2 00
Best display apiarian implements, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best collection honey producing plants, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best collection of bee literature, H. D. Cutting, Clinton	10 00
2d do., W. Z. Hutchinson, Rogersville	5 00
Best and largest exhibit in this department, W. Z. Hutchinson, Rogersville	10 00
2d do., H. D. Cutting, Clinton	6 00

A. B. MASON,
Judge.

DIVISION L—MANUFACTURED GOODS.

CLASS 52—MATERIALS.

Best display of fine wools, L. W. & O. Barnes, Byron	$7 00
2d do., M. M. Kennedy, Liberty	5 00
3d do., C. Hibbard & Son, Bennington	3 00
Best display of long wools, Frank Willson, Jackson	7 00
2d do., A. F. Wood, Mason	5 00
3d do., M. E. Bartlett, Jackson	3 00
Best display of middle wools, Frank Willson, Jackson	7 00
2d do., C. A. Searing, Lyons	5 00
3d do., M. E. Bartlett, Jackson	3 00
Best display of prepared flax, Mrs. Lucy McClary, Galesburg	5 00

NON-ENUMERATED.

Display of wool, D. B. Harrington, Mason	7 00

GEO. T. WOOD,
G. W. WESTFALL,
Judges.

CLASS 55—ARTICLES OF LEATHER AND INDIA RUBBER.

Best display of trunks, Merriman & Co., Jackson	$10 00
2d do., J. A. Campbell, Jackson	5 00
Best double carriage made in Michigan, Merriman & Co., Jackson	3 00
2d do., J. A Campbell, Jackson	2 00
Best single buggy harness, Merriman & Co., Jackson	3 00
2d do., J. A. Campbell, Jackson	2 00
Best double harness for farm use, Merriman & Co., Jackson	3 00
Best display of leather, Conley & Davis, Jackson	3 00
Best riding bridle, Merriman & Co., Jackson	2 00
Best horse collar, J. D. Lane, Onondaga	2 00
2d do., Merriman & Co., Jackson	1 00
Best display of leather belting, Warner & Dodge, Jackson	2 00
Best display of boots and shoes, C. H. Fargo & Co., Jackson	10 00

NON-ENUMERATED.

Case of felt boots and shoes, Sheldon Bros., Hillsdale	3 00

J. T. COBB,
J. F. VANDEVENTER,
Judges.

CLASS 56—ARTICLES OF FURNITURE.

Best display of furniture, H. C. Ransom, Jackson	$25 00
2d do., Henry Simmons, Jackson	15 00
Best set of parlor furniture, H. C. Ransom, Jackson	20 00
Best set of chamber furniture, H. C. Ransom, Jackson	10 00
2d do., Henry Simmons, Jackson	7 00
Best center table, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best desk, Henry Simmons, Jackson	3 00
Best easy chair, Henry Simmons, Jackson	3 00
2d do., H. C. Ransom, Jackson	2 00
Best lounge or couch, H. C. Ransom, Jackson	3 00
2d do., Henry Simmons, Jackson	2 00
Best library table, Henry Simmons, Jackson	3 00
Best mantel mirror, H. C. Ransom, Jackson	5 00
2d do. Mrs. T. Gunnison, Jackson	3 00
Best mattress for bed, H. C. Ransom, Jackson	2 00
Best office chair, Henry Simmons, Jackson	2 00
Best mirror base, H. C. Ransom, Jackson	5 00

Best sofa, Henry Simmons, Jackson	$3 00
2d do., H. C. Ransom, Jackson	2 00
Best smoking or lounging chair, Henry Simmons, Jackson	3 00
Best upholstered reception chair, H. C. Ransom	3 00
2d do., Henry Simmons, Jackson	2 00

NON-ENUMERATED.

Bed spring, D. Kellogg, Jackson	$1 00
Hammock chair, Z. S. Moore	1 00
Burial caskets, Owosso Casket Co., Owosso	5 00
Book case and secretary, H. W. Stanbridge, Jackson	3 00
Rattan rocker, Henry Simmons, Jackson	2 00
Inlaid box, H. W. Stanbridge, Jackson	1 00
Baby teeter, J. W. Hewett, Jackson	3 00

E. A. STRONG.
B. G. BUELL.
Judges.

CLASS 57—STONE, IRON AND ORNAMENTAL WORK.

Best parlor grate, Warner & Dodge, Jackson	$2 00

NON-ENUMERATED.

Carriage steps, Lusk & Co., Jackson	$2 00

JOHN TRUE,
W. H. HAIGHT,
Judges.

DIVISION N—ART.

CLASS 61—PAINTING, SCULPTURE, ETC.

Best collection of oil paintings, A. J. Brow, Detroit	$250 00
Best collection of water colors, A. J. Brow, Detroit	25 00
Best historical painting in oil, A. J. Brow, Detroit	20 00
2d do., A. J. Brow, Detroit	10 00
Best landscape in oil, Michigan scenery, A. J. Brow, Detroit	10 00
2d do , A. J. Brow, Detroit	5 00
Best landscape in oil, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best landscape water colors, Michigan scenery, A. J. Brow, Detroit	8 00
2d do., A. J. Brow, Detroit	5 00
Best marine painting in oil, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best portrait in oil, A. J. Brow, Detroit	10 00
2d do., Perry J. Averill, Jackson	5 00
Best pastel landscape painting, A. J. Brow, Detroit	5 00
2d do., A. J. Brow, Detroit	3 00
Best special subject in oil, A. J. Brow, Detroit	5 00
2d do., A. J. Brow, Detroit	3 00
Best special subject in water colors, A. J. Brow, Detroit	5 00
2d do., A. J. Brow, Detroit	3 00
Best winter piece in oil, A. J. Brow, Detroit	10 00
2d do., A. J. Brow, Detroit	5 00
Best display of gilt frames, A. J. Brow, Detroit	5 00
Best display of frames, bronze or wood, A. J. Brow, Detroit	5 00
Best animal photograph, Clara Coston, Jackson	2 00
Best collection of photographs, J. J. Gibson, Ann Arbor	10 00
2d do., Clara Coston, Jackson	5 00
Best cabinet photograph, J. J. Gibson, Ann Arbor	2 00
2d do., Clara Coston, Jackson	1 00
Best colored portrait photograph, Miss E. N. Barnum, Adrian	2 00
2d do., Miss Nellie S. Heusted, Fenton	1 00

BY PROFESSIONAL ARTISTS AND TEACHERS.

Best animal piece from life in oil, W. H. Machen, Detroit	$10 00
2d do., Clara Coston, Jackson	5 00
Best animal painting in water colors, W. H. Machen, Detroit	5 00
Best bird piece in oil, W. H. Machen, Detroit	5 00
2d do., W. H. Machen, Detroit	3 00
Best composition landscape in oil, Robert Hopkins, Detroit	5 00
2d do., Robert Hopkins, Detroit	3 00
Best collection of five oil paintings, Robert Hopkins, Detroit	10 00
2d do., W. B. Coneley, Detroit	5 00
Best collection of five water color paintings, John Owen, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best fruit piece in oil, W. H. Machen, Detroit	5 00
2d do., Mrs. W. F. Antisdel, Detroit	3 00
Best fancy painting in oil, W. B. Coneley, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best fancy painting in water colors, Mrs. Garretson, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best historical painting in oil, John B. Potter, Lansing	5 00
Best landscape in oil from nature, Robert Hopkins, Detroit	10 00
2d do., John Owen, Detroit	5 00
Best landscape in water colors, Robert Hopkins, Detroit	10 00
2d do., John Owen, Detroit	5 00
Best marine scene in oil, Robert Hopkins, Detroit	10 00
2d do., Josie B. Mann, Jackson	5 00
Best portrait from life large size, W. H. Machen, Detroit	5 00
2d do., W. B. Coneley, Detroit	5 00
Best portrait from life, cabinet size, W. H. Machen, Detroit	5 00
2d do., Mrs. W. F. Antisdel, Detroit	3 00
Best pastel portrait, —— Dennis, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best winter piece in oil, Mrs. W. F. Antisdel, Detroit	5 00
2d do., Clara Coston, Jackson	3 00
Best crayon portrait, Clara Coston, Jackson	5 00
2d do., Kate L. Booth, Kalamazoo	3 00
Best pastel painting, Clara Coston, Jackson	5 00
2d do., Clara Coston, Jackson	3 00

NON-ENUMERATED.

Satin painting, Miss H. M. Edgar, Jackson	1 00
Display of bronze, W. R. King & Co., Detroit	3 00
Fire screen in oil, Miss E. N. Barnum, Adrian	3 00
Outdoor group work, J. J. Gibbs, Ann Arbor	3 00
Collection of portraits in India Ink, Cassidy & Co., Deep River	5 00

FOSTER PRATT,
W. H. WITHINGTON,
F. B. STOCKBRIDGE,
Judges.

CLASS 62—PAINTING AND DRAWING BY AMATEUR ARTISTS.

Bird piece in oil, W. N. Adams, Jackson	$3 00
2d do., Mrs. G. M. Devlin, Jackson	2 00
Best collection of 5 oil paintings, Mrs. W. K. Gibson, Jackson	3 00
2d do., Mrs. J. Gunnison, Jackson	2 00
Best collection of 5 water color paintings, Mrs. W. K. Gibson, Jackson	3 00
2d do., Mrs. G. M. Devlin, Jackson	2 00
Best collection of 5 paintings on slate, Mrs. W. K. Gibson, Jackson	5 00
Best display of 25 pieces decorated porcelain, Mrs. W. B. Webb, Jackson	10 00
2d do., Mrs. W. K. Gibson, Jackson	5 00
Fruit piece in oil, S. Robinson, Albion	3 00
Best flower piece in oil, Mrs. W. K. Gibson, Jackson	3 00
2d do., Miss E. N. Barnum, Adrian	2 00
Best fancy painting in water colors, Florence Whipps, Marion, Ohio	3 00
2d do., Mrs. D. C. Meseroll, Jackson	2 00

Best landscape in oil of Michigan scenery, Mrs. J. Gunnison, Jackson	$5 00
Best landscape in water colors, Miss Florence Whipps, Marion, Ohio	5 00
2d do., Mrs. G. M. Devlin, Jackson	3 00
Best marine scene in oil, Mrs. G. M. Devlin, Jackson	3 00
2d do., Mrs. J. Gunnison, Jackson	2 00
Best oil painting by a person under 15 years old, S. Robinson, Albion	5 00
2d do., Miss Grace W. Ford, Jackson	3 00
Best painting on porcelain, Miss Kate L. Booth, Kalamazoo	3 00
2d do., Mrs. H. M. Griswold, Jackson	2 00
Best painting on ebonized panel, Miss Kate L. Booth, Kalamazoo	3 00
2d do., Mrs. W. K. Gibson, Jackson	2 00
Best painting on holly, Mrs. W. K. Gibson, Jackson	2 00
2d do., Miss Nellie S. Heusted, Fentonville	1 00
Best painting on plaque, Mrs. W. K. Gibson, Jackson	3 00
2d do., Miss Grace W. Ford, Jackson	2 00
Best painting on slate, Mrs. W. K. Gibson, Jackson	3 00
2d do., Mrs. J. Gunnison, Jackson	2 00
Best crayon drawing of face, Miss Kate L. Booth, Kalamazoo	3 00
2d do., Miss Olive Dikeman, Three Rivers	2 00
Best crayon drawing of animal, Miss Grace W. Ford, Jackson	3 00
Best crayon drawing of landscape, F. H. Haywood, Mt. Clemens	2 00
2d do., John B. Potter, Lansing	1 00
Best India ink drawing, L. O. Reber, Jackson	2 00
Pencil drawing of animal, M. E. Bartlett, Jackson	1 00
Pencil drawing of landscape, M. E. Bartlett, Jackson	1 00
Best pencil drawing by a person under 14 years of age, M. E. Bartlett, Jackson	2 00
Best flower piece in oil, Miss Kate L. Booth, Kalamazoo	1 00

NON-ENUMERATED.

Painted banner, Miss Kate L. Booth, Kalamazoo	2 00
Colored photograph, Miss Kate L. Booth, Kalamazoo	2 00
Specimen of painting on wood, Mrs. D. C. Meseroll, Jackson	1 00
Etched lichen, Miss C. Chapman, Reading	1 00
Collection bracket painting, Mrs. F. A. Bradley, Jackson	2 00
Clay modeling by hand, Mrs. F. A. Bradley, Jackson	2 00
Collection of crayon drawing, Miss Grace W. Ford, Jackson	2 00
Fancy painting on felt, Mrs. Capt. Tynell, Jackson	2 00
Painting on velvet, Mrs. B. Baker, Three Rivers	2 00
Crayon drawing of figure, F. H. Haywood, Mt. Clemens	3 00
Painting on slate, Miss Nellie S. Heusted, Fentonville	1 00
Collection of painting on tiles, Mrs. S. E. Wells, Jackson	2 00

FOSTER PRATT,
W. H. WITHINGTON,
F. B. STOCKBRIDGE,
Judges.

DIVISION O—NEEDLE AND FANCY WORK.

CLASS 63—ARTICLES OF LADIES' DRESS.

Best corset, Mother Hubbard Corset Co., Detroit	$2 00
Best display of millinery goods, J. C. Richardson & Co., Jackson	5 00
Best infant's suit, A. D. Quick, Jackson	1 00
Best lady's trimmed bonnet, Miss Nellie S. Heusted, Fentonville	1 00

MRS. H. B. HAYDEN,
MRS. W. B. WEBB,
MRS. THOMPSON,
Judges.

CLASS 64—PLAIN NEEDLE AND FANCY WORK.

Best sample of braiding by hand, Mrs. C. B. Westren, Henrietta	$1 00
2d do., Will N. Adams, Jackson	50

Best darning, Mrs. M. A. Chisholm, Marshall	$1 00
2d do., Mrs. C. B. Westren, Henrietta	50
Best hemstitching, Mrs. F. A. Bradley, Jackson	2 00
2d do., Miss C. Chapman, Reading	1 00
Best pair plain handkerchiefs by hand, M. E. Bartlett, Jackson	1 00
2d do., Mrs. A. M. Stearns, Kalamazoo	50
Best pair plain pillow cases by hand, Mrs. M. A. Chisholm, Marshall	1 00
2d do., Mrs. Lucy McClary, Galesburg	50
Best plain sheets by hand, Mrs. M. A. Chisholm, Marshall	1 00
2d do., Mrs. Lucy McClary, Galesburg	50
Best plain white muslin quilt by hand, Mrs. Lucy McClary, Galesburg	2 00
Best calico patchwork quilt by hand, Miss Satie Kennedy, Jackson	2 00
Best silk patchwork quilt by hand, Mrs. J. N. Porter, Jackson	5 00
2d do., Mrs. Jessie Cady, Grand Rapids	3 00
Best worsted patchwork quilt by hand, S. A. Schermerhorn, Jackson	2 00
2d do., Miss Nellie S. Heusted, Fentonville	1 00

NON-ENUMERATED.

Plush quilt, pieced by hand, Miss Ann Champlain, Three Rivers	2 00
Crazy quilt, Mrs. Nellie McDuff, Jackson	1 00
Hand painted bed spread, Mrs. D. C. Meseroll, Jackson	5 00

MRS. H. B. HAYDEN,
MRS. W. B. WEBB,
MRS. THOMPSON,
Judges.

CLASS 65—EMBROIDERY AND ORNAMENTAL NEEDLE WORK.

Best applique embroidery in silk or worsted, Miss Nettie Leader, Jackson	$2 00
2d do., Miss A. B. Chandler, Coldwater	1 00
Best arasene embroidery, Mrs. D. C. Meseroll, Jackson	2 00
2d do., Miss A. B. Chandler, Coldwater	1 00
Best chenille embroidery, Mrs. Cora Hall, Jackson	2 00
2d do., Mrs. C. B. Westren, Henrietta	1 00
Best crewel embroidery, Mrs. C. B. Albertson, Fenton	2 00
2d do., Miss Gertie McClary, Galesburg	1 00
Best Kensington embroidery, Mrs. Elmer Hills, Delaware, Ohio	2 00
2d do., Mrs. C. B. Westren, Henrietta	1 00
Best collection of embroidery, Mrs. F. G. Stebbins, Adrian	6 00
2d do., Mrs. Elner Hills, Delaware, Ohio	4 00
Best embroidered banner, Mrs. Elner Hills, Delaware, Ohio	2 00
2d do., W. N. Adams, Jackson	1 00
Best embroidered chair or ottoman cover in silk, Mrs. F. B. Stebbins, Adrian	2 00
2d do., Mrs. Elner Hills, Delaware, Ohio	1 00
Best embroidered chair or ottoman in worsted, Mrs. Frank Johnson, Pontiac	2 00
2d do., Mrs. C. B. Westren, Henrietta	1 00
Best embroidered dressing gown, Mrs. S. E. Wells, Jackson	3 00
Best embroidered foot rest, Mrs. C. B. Alberton, Fenton	1 00
2d do., Mrs. Eliot Thompson, Adrian	50
Best embroidered fire screen, Mrs. F. G. Stebbins, Adrian	4 00
2d do., Mrs. D. C. Meseroll, Jackson	2 00
Best embroidered handkerchief in cotton or linen, Mrs. S. E. Wells, Jackson	1 00
Best embroidered infant's blanket in silk, Miss Carrie H. Choate, Jackson	1 00
Best embroidered infant's dress, Mrs. A. B. Chandler, Coldwater	1 00
2d do., Mrs. Elner Hills, Delaware, Ohio	1 00
Best embroidered letter in silk, Miss Carrie H. Choate, Jackson	1 00
2d do., Mrs. C. B. Westren, Henrietta	50
Best embroidered dress or cloak in silk, Mrs. Elner Hills, Delaware, Ohio	3 00
2d do., Mrs. J. H. Dennis, Hastings	1 00
Best embroidered night dress, Mrs. J. H. Cowing, Henrietta	2 00
2d do., Mrs. A. M. Stearns, Kalamazoo	1 00
Best embroidered pillow shams in cotton or linen, Miss L. Peek, Jackson	2 00
2d do., Miss Carrie H. Choate, Jackson	1 00
Best embroidered piano or table cover, Mrs. D. C. Meseroll, Jackson	4 00
2d do., Mrs. Cora Hall, Jackson	2 00

Best embroidered sofa pillow in silk, Mrs. D. M. Fleming, Jackson	$3 00
2d do. Mrs. C. W. Westren. Henrietta	1 00
Best embroidered tidy in silk, Mrs. F. G. Stebbins, Adrian	2 00
2d do., Miss A. B. Chandler, Coldwater	1 00
Best embroidered toilet set, Mrs. F. G. Stebbins, Adrian	2 00
2d do., Miss Nettie Leader, Jackson	1 00
Best embroidered table scarf, Mrs. F. G. Stebbins, Adrian	2 00
2d do., Miss Kate L. Booth, Kalamazoo	1 00
Best cut or tufted work, Miss Nellie E. Heusted, Fentonville	2 00
2d do., Mrs. S. E. Wells, Jackson	1 00
Best collection of lace work, Mrs. H. A. Stickney, Jackson	3 00
2d do., Mrs. L. M. Salisbury, Hudson	2 00
Best Honiton lace, Mrs. L. M. Salisbury, Hudson	2 00
2d do., Miss Nellie S. Heusted, Fentonville	1 00
Best drawn work, Mrs. D. M. Fleming, Jackson	2 00
2d do., Miss L. Peck, Jackson	1 00
Best darned net work, Miss A. B. Chandler, Coldwater	1 00
2d do., Mrs. D. Harbaugh, Jackson	50
Best darned net work pillow shams and bed spread, Miss L. Brockway, Somerset Center	3 00
2d do., Mrs. O. Robinson, Albion	2 00
Best etching in cotton, linen or silk, Mrs. J. H. Dennis, Hastings	2 00
2d do., Mrs. W. K. Gibson, Jackson	1 00
Best fancy pin cushion, Mrs. D. M. Fleming, Jackson	1 00
2d do., Mrs. C. B. Westren, Henrietta	50
Best fancy bag, Mrs. W. K. Gibson, Jackson	1 00
2d do., Miss A. B. Chandler, Coldwater	50
Best fancy apron, Mrs. F. G. Stebbins, Adrian	1 00
2d do., Miss Jessie Cady, Grand Rapids	50
Best home-made rug crochet or knit. Miss Jessie Cady, Grand Rapids	2 00
2d do., Mrs. W. D. Martin, Henrietta	1 00
Best home-made rug, drawn, C. Eldridge, Albion	2 00
2d do., H. C. Richardson, Sandstone	1 00
Pair lamp mats in worsted, Mrs. E. Thompson, Adrian	50
Best pair slippers in silk or worsted. Mrs. Elner Hills, Delaware, Ohio	1 00
Best macrame work, Mrs. C. B. Westren, Henrietta	2 00
2d do., Mrs. F. A. Bradley, Jackson	1 00
Best mantel lambrequin, Mrs. A. B. Bolton, Jackson	2 00
2d do., Miss Nettie Leader, Jackson	1 00
Best rick-rack specimen, Miss A. B. Chandler, Coldwater	1 00
2d do., M. E. Bartlett, Jackson	50
Best sample raised work, W. N. Adams, Jackson	1 00
2d do., Mrs. Frank Johnson, Pontiac	50
Best toilet set in lace or muslin, M. E. Bartlett, Jackson	1 00
2d do., Mrs. C. B. Westren, Henrietta	50
Best tatting, Mrs. C. B. Westren, Henrietta	1 00
2d do., M. E. Bartlett, Jackson	50

NON-ENUMERATED.

Display of fancy articles, G. A. Saduorian, Ann Arbor	5 00
Log cabin quilt, Miss Hattie Clough, Tompkins Center	50
Display of silk worms, Miss Emma A. Eddy, Hillsdale	50
Chemise, Mrs. Ann Marshall, Parma	2 00
Tidy, Mrs. Ann Marshall, Parma	50
Turkish foot rest, Mrs. Elliot Thompson, Adrian	1 00
Table cover, Miss Mary B. Robinson, Jackson	3 00
Satin tidy, Mrs. Elliot Thompson, Adrian	50

MRS. H. B. HAYDEN,
MRS. W. B. WEBB,
MRS. THOMPSON,
Judges.

CLASS 66—CROCHET, KNIT AND FANCY WORK.

Best Afghan robe, Mrs. D. M. Fleming, Henrietta	$5 00
2d do., Miss Kate L. Booth, Kalamazoo	3 00
Best bed spread, crochet or knit, Miss L. Peck, Jackson	3 00
2d do., Mrs. Frank Johnson, Pontiac	2 00
Best cotton tidy, Miss Nettie Yenor, Tompkins Center	2 00
Child's Afghan robe, Mrs. C. B. Westren, Henrietta	1 00
Best child's shirt, Miss Carrie H. Choate, Jackson	2 00
Best collection of work in this class, M. E. Bartlett, Jackson	5 00
2d do., Mrs. Elliot Thompson, Adrian	3 00
Best fancy mittens, Mrs. L. E. Knight, Gaines	2 00
2d do., M. E. Bartlett, Jackson	1 00
Best fancy purse, Miss C. Chapman, Reading	1 00
2d do., W. N. Adams, Jackson	50
Gent's scarf, Miss Julia Vanderlyn, Jackson	1 00
Best hood, crochet or knit, Mrs. C. B. Westren, Henrietta	2 00
2d do., Miss Carrie Choate, Jackson	1 00
Best infant's shoes, Miss Carrie Choate, Jackson	1 00
2d do., Mrs. Elliot Thompson, Adrian	50
Leggins, crochet or knit, Levi Swann, Dansville	1 00
Best lady's sacque, Mrs. Elliot Thompson, Adrian	2 00
Best skirt, crochet or knit, Mrs. Heber Coddington, Kalamazoo	2 00
2d do., Mrs. Marie Caldwell, Grass Lake	1 00
Best shawl, crochet or knit, Miss Minnie R. DePuy, Jackson	3 00
2d do., Miss A. B. Chandler, Coldwater	2 00

NON-ENUMERATED.

Bed spread and sham, Mrs. M. A. Hubbard, Grand Rapids	2 00
Specimen of knit work, Mrs. W. D. Martin, Henrietta	1 00
Pair of knit wool hose, Mrs. H. Stearns, Somerset	50
Fancy cotton stockings, Miss Nellie Yenor, Tompkins Center	50

MRS. H. B. HAYDEN,
MRS THOMPSON,
MRS. W. B. WEBB.
Judges.

CLASS 67—HAIR, SHELL AND WAX WORK.

Best artificial flowers in silk, Mrs. Caddie Webster, Jackson	$2 00
Best display of hair work, Mrs. J. F. Avery, Jackson	3 00
Best display of shell work, Miss Lucille Berger, Tecumseh	2 00
Best display of wax work, Mrs. Ella Swan, Jackson	3 00

NON-ENUMERATED.

Etched lichen, Miss C. Chapman, Reading	50
Feather bouquet, A. S. Fish, Parma	50
Wax cross, Z. S. Moore, Jackson	1 00

MRS. H. B. HAYDEN,
MRS. THOMSON,
MRS. W. B. WEBB,
Judges.

DIVISION P—MISCELLANEOUS.

CLASS 68—MISCELLANEOUS ARTICLES.

Best display of fire brick, Jackson Fire Clay Co., Jackson	$3 00
Best barrel of fine salt, J. W. Fleming, Jackson	3 00
Best barrel of ground plaster, J. W. Fleming, Jackson	2 00
Best specimen of iron ore, Thomas Westren, Jackson	2 00
Best collection of monumental work, S. Gregory & Co., Albion	10 00
Best native copper, John J. Dever, Jackson	2 00
Best silver ore, John J. Dever, Jackson	2 00
Best work in marble, C. W. Hills, Jackson	5 00

NON-ENUMERATED.

Display of fire clay goods, Bennett Sewer Pipe Co., Jackson	$10 00
Display of linseed oil cake, E. W. Blatchford & Co., Chicago, Ill	2 00
Display of soft ground horse shoes, L. Brigham, Orangeville	2 00
Display of paint, Detroit White Lead Co., Detroit	Diploma
Display of sewer pipe and tile, Jackson Fire Clay Co., Jackson	7 00
Display of paving brick, Jackson Fire Clay Co., Jackson	2 00
Horse, cattle and poultry food, L. A. Raven & Co., Chicago, Ill	2 00
Display of carp, G. E. Morey, Reading	5 00
Case of hand made horse shoes, H. J. Winters & Bros., Eaton Rapids	5 00
Case of hand-made horse shoes, A. Manne, Lansing	3 00
Never slip horse shoe calk, Fred Carlisle, Detroit	3 00

HENRY CHAMBERLAIN.
T. D. DEWEY,
Judges.

CLASS 69—HOUSEHOLD ARTICLES.

Best fruit dryer, W. L. Plummer, Detroit	$5 00

NON-ENUMERATED.

Clothes reel, Perry & Cooley, Battle Creek	3 00

T. D. DEWEY.
HENRY CHAMBERLAIN.
Judges.

DIVISION Q—CHILDREN'S DEPARTMENT.

Best specimen of hand sewing, Eva Stearns, Kalamazoo	$2 00
2d do., Anna Fellows, Manchester	1 00
Specimen of patchwork, Eva Stearns, Kalamazoo	50
Calico patchwork quilt, M. Messmer, Jackson	50
Best specimen of painting on wood, M. Messmer, Jackson	1 00
Best hanging basket, M. Messmer, Jackson	50
Sample of canned fruit, Eva Stearns, Kalamazoo	50
Sample of jelly, Eva Stearns, Kalamazoo	50
Best specimen of penmanship, Emily E. Warner, Jackson	1 00
2d do., Frank J. Maywood, Blackmore	50

MRS. H. B. HAYDEN.
MRS. W. B. WEBB,
MRS. THOMPSON,
Judges.

REPORTS FROM LOCAL SOCIETIES.

ALPENA COUNTY AGRICULTURAL SOCIETY.

To the Secretary of the State Board of Agriculture, Lansing, Mich.:

Dear Sir:—I herewith submit my report of the Ninth Annual Fair of the Alpena Agricultural Society, held October 7, 8 and 9, 1886:

To receipts, including county appropriations		$498 02

DISBURSEMENTS.

For premiums per annexed schedule	$263 50	
Other incidental expenses	95 00	
		358 50
Balance excess of receipts		$139 52

Against this balance there is to be paid the annual interest of the bonded debt of the Society, about $215.

CLASSIFICATION OF PREMIUMS AWARDED.

Department A—Stock.

Class 1, Horses	$43 00
Class 2, Short-horn cattle	3 50
Class 4, Holsteins	20 50
Class 5, Jersey	5 00
Class 6, Graded	15 00
Class 7, Long-wool sheep	25 00
Class 8, Swine	5 00
Class 9, Poultry	2 00

Department B.

Class 1, Grain	23 50
Class 2, Roots, etc	37 00
Class 3, Fruits	15 00

Department C.

Class 1, Flowers	7 00
Class 2, Ornamental and artistic	6 50
Class 3, Domestic	18 50

Department D.

Class 1, Dairy and household	$23 50
Class 2, Domestic and mechanical	13 50
	$263 50

All of which is respectfully submitted.

W. E. ROGERS,
Secretary.

ALPENA, Mich., Nov. 12, 1886.

INDEX.

INDEX.

A.

PAGE.

- Abandoned lands of America 216
- Acadia wheat, notes on 229
- Act for inspection of commercial fertilizers 245
- Accounts of Agricultural College vi
    - Farm Department viii
    - Garden Department ix
    - Secretary vi
    - Special Appropriations xvi
    - Student Labor xv
- Acme tomato described 241
- Adams, Chas., paper on Butterine and Oleomargarine 119
- Adler, Prof., school for workingmen lvi
- Admission to Agricultural College, proper standard of xvii
- Advance tomato described 241
- Agricultural Barometer 98
    - College Accounts vi
        - Alumni, occupations of 49
        - Aboretum, bulletin on 250
        - Assets of xi
        - Board of control iv
        - Bulletins 223
        - Drainage of swamps at 159
        - Graduates, compared with those of University 49
            - occupations of 49
        - Income since foundation xv
        - Interest fund xiii
        - Inventory x
        - Lands, sales of in 1886 xiv
            - and forfeitures since 1867 xii
            - vacant Oct. 1, 1886, by counties xiv
        - Officers of v
        - Resources of xi
        - Salaries of officers ix
        - Shop work at l
        - Standard of Admission, best for xvii
        - Stock sale at xxiv
        - Talks about, by President Willits 215
        - Trust Fund xiii
        - Veterinary science at 125
    - Education in Europe 218
        - Paper by Mrs. J. C. Wilson 192
        - remarks on by Prof. S. Johnson 47
    - Society, State (see State Agricultural Society).

Page.

Agriculture, members of State Board of ... iv
  needs of, paper by Prof. S. Johnson ... 43
  Relation of Veterinary science to, by Prof. Grange ... 123
  Report of Professor of ... xxi
Alpha tomato described ... 239
Alumni of Agricultural College, occupations of ... 49
Alpena County Society Report ... 294
Alward, Robert, paper on Farmers' organizations, and policy ... 29
American breeds of cattle ... 116
  farms abandoned ... 216
  merino sheep, premiums on, at State Fair ... 272
  periodicals in library ... lxxiii
Ammonia in commercial fertilizers ... 249
Ammoniated bone superphosphates analyzed ... 248
Authrenus Scrophulariae ... 225
Analysis of commercial fertilizers—bulletin on ... 245
Analysis of commercial fertilizers—table of ... 248
Animals running at large—law of ... 18
Annapolis Naval Academy—Report on ... lvi
Annual stock sale at College ... xxiv
Apiary products, premiums at State Fair ... 285
Apiary, reasons for enlargement of ... xxxiv
Appleion, T., paper on roads and road making ... 151
Apple trees Paris green for, by Prof. A. J. Cook ... 135
Appropriations for Agricultural College for 1885 and 1886, account with ... xvi
    since foundation ... xv
  Agriculture in Europe ... 218
Arboretum of Agricultural College—Bulletin on ... 250
Arsenites for insects, by Prof. A. J. Cook ... 134
Ashes, effect of on insects and foliage ... xli
Assets of Agricultural College ... xi
Astronomy, Report of Prof. of ... lv
Autocrat tomato described ... 241
Average Farm—Can it be made Profitable? by J. J. Snook ... 41

B.

Bailey, Mrs. H. C., poetry of the farm ... 14
  Prof. L. H., jr, bulletin on tomatoes ... 233
    paper on style in farming ... 56
Ball, Hon. Wm., paper, success on the farm ... 38
Bark lice, kerosene emulsion for ... 138
Barley or corn for cattle, discussion of ... 10
Barometer of Agriculture ... 98
Beal, Prof. W. J., paper on red clover ... 76
    bulletin on growing forest trees ... 250
    annual report ... xlii
Beauty for farmers ... 58
Bees, etc., premiums at State Fair ... 285
  fertilizing red clover, by Prof. W. J. Beal ... 79
Berkshires, premiums at State Fair ... 276
Birds, distribution of seeds by ... 251
Board of Agriculture, members of ... iv
Bone fertilizer analyzed ... 248
Book farming, paper by Mrs. J. C. Wilson ... 192
Boston market tomato described ... 239
Botanical laboratory, picture of ... xliv
  Professor's report ... xlii

Page.

Botanical exhibit at State Fair ... xliii
department, donations to ... xlvi
bulletin on growing forest trees ... 250
Botritis infestans, cause of potato rot ... 106
Bow, Dennis, paper on wheat culture in Saginaw county ... 101
Bread, premiums on at State Fair ... 284
Breeders' stock, premiums at State Fair ... 269
Breeds of cattle, relative merits of ... 114
Bricklaying, how taught at industrial schools ... lvi
Bridge over Cedar river ... xxiii
Broad tires, value of ... 154
Bronze foilage tomato ... 240
Buckeye phosphate analyzed ... 248
Buffalo carpet moth, bulletin on ... 223
Superphosphate No. 2, analysis of ... 248
Buggy horses, premiums at State fair ... 271
Buhach, by Prof. A. J. Cook ... 136
experiments with ... xli
Bulletin No. 17, The carpet beetle ... 223
18, varieties of wheat ... 227
19, on tomatoes ... 233
20, analysis of commercial fertilizers ... 245
21, on growing forest trees ... 250
Bumble bees and red clover ... 79
Butterine and oleomargarine, paper by Charles Adams ... 119
Butter premiums, etc., at State Fair ... 286
yield to 100-weight of milk ... 118

C.

Cabbage caterpillar, Buhach or Pyrethrum for ... 136
kerosene emulsion for ... xxxviii
flea beetle, tobacco for ... xli
maggot, kerosene emulsion for ... xxxix, 138
Cadets at Agricultural College, number at drill ... lxvii
California pyrethrum, experiments with by Prof. Cook ... xli
use of, by Prof. Cook ... 136
Campbell, Hon. M. D., paper—Social rank of farmers ... 188
Canada thistles, how to kill, by J. S. Woodward ... 84
Victor tomato described ... 240
Can average farms be made profitable, paper by J. J. Snook ... 41
Canker worms, Paris green for, by Prof. A. J. Cook ... xl, 135
Cannon, Mr. G. H., paper on Wilds of Michigan ... 178
Mrs. L. E., poem—"Let the secret out" ... 184
"Music" ... 200
"What can women do?" ... 199
Capacity of tile, by Prof. R. C. Carpenter ... 171
Capital and Labor, paper by Hon. C. V. R. Pond ... 20
Carbolic acid emulsion, effect on plants and insects ... xxxix
Cardinal tomato described ... 240
Carpenter, Prof. R. C., annual report ... xlviii
paper on improvement of muck swamps ... 154
size of drain tile ... 171
Carpenters' tools, students' sets of at Agricultural College ... xlix
Carpet beetle, bulletin on ... 223
Carriage horses, premium at State Fair ... 271
Caste in America ... 189
Cattle, American breed of ... 116

Page.
Cattle how improve common? paper by Edwin Phelps 112
loss in raising scrub 113
stinting food of 115
premiums on at State Fair 263
relative merits of different breeds discussed 114
running at large, law as to 18
Cedar River, bridge over xxiii
Celery as a crop for swamp land 169
Certificate of commercial fertilizers 246
Challenge Corn-Grower fertilizsr analyzed 248
Chamberlain, Wm., election of, as president of State Agricultural Society 260
Champion Amber wheat, notes on 228-230
Chandler farm, drainage of 161
Cheese, premiums on at State Fair 284
Chemical analysis of fertilizers 249
Department, bulletin on analysis of fertilizers 245
report of xxxii
Chemicals of agriculture 93
Chemistry for farmers 195
Cherry Aphis and carbolic acid emulsion xxxix
kerosene emulsion xxxix
slug and kerosene emulsion xxxviii
tomato described 242
Chester White swine, premiums on at State Fair 277
Children's Department, premiums at State Fair 293
Clarke, Sec'y A., on granges 35
Classification of wood for fuel liii
Clawson wheat, notes on, as grown at College farm 227-231
Clay beds, formation of 145
soils or sandy soils, relative merits discussed 71
Cleveland Bay Horses, premiums on, at State Fair 267
Dryer Company's fertilizers analyzed 248
Climatic limit of peaches 129
Climax tomato described 241
Clover, cutting of, best time for 86
for killing Canada thistles 84
restoring exhausted soils 74
green curing of 91
hay, time to cut 86
plowed under, how best done 69
when best done 90
red, paper on, by Prof. W. J. Beal 76
seed, light or dark, difference in value 87
saving of 86
stubble, amount of per acre 81
variation in 87
Clydesdales, premiums on at State Fair 270
Coarse wool sheep, premiums at State Fair 275
Codling moth, effect of Paris Green on xli, 135
Coleman, M. L., report as treasurer vii
Combination for farmers, by Robert Alward 29
Commercial fertilizers, bulletin on analysis of 245
law for inspection of 245
questionable economy of 70
what constitutes value of 93
Committees, standing, of State Agricultural Society 255
Common cattle, how to improve, paper by Edwin Phelps 112

Page.

- Common law, meaning of term ... 17
  - schools, paper by Joshua VanHoosen ... 201
- Composition of fertilizers ... 249
- Conqueror tomato described ... 239
- Construction or Instruction at schools of Technology ... lix
- Conversation, art of, declining ... 199
- Cook, Prof. A. J., annual report ... xxxiii
  - bulletin on carpet beetle ... 223
  - experiments by ... xxxviii
  - paper on four important insecticides ... 133
- Cook's Favorite tomato described ... 239
- Co-operation by farmers, Robert Alward ... 29
- Corn, cost of raising in Michigan ... 26
- Corporations, evils of ... 31
- Cost of raising grains in Michigan ... 25
- Cotswold sheep, premiums at State Fair ... 275
- Counties containing College lands ... xiv
- Country boys at college ... 216
  - graded schools ... 206
- Courtesy, value of ... 191
- Covering soil to preserve fertility ... 70
- Cow-grass ... 89
- Cows, care of, by Geo. St. Clair ... 117
- Crimean wheat ... 229
- Criterion tomato described ... 242
- Crocker Chemical Works' fertilizers analyzed ... 248
- Cropping list of Agricultural College farm ... xxvi
  - of peat soils, paper by W. Asa Rowe ... 175
- Crops for drained swamp lands ... 169
  - at Agricultural College ... 160
- Crozier, A. A., paper on Potato Rot ... 103
- Cultivating wheat ... 102
- Culture, paper on, by Mrs. T. B. Fox ... 196
- Curculio, treatment of ... 141
- Curl in potatoes, paper by A. A. Crozier ... 103
- Current account expenses of Agricultural College ... vii
  - appropriations for since 1856 ... xv
  - receipts of Agricultural College ... vii
- Currant tomato described ... 243
- Cut of botanical laboratory ... xliii
- Cut of mechanical building ... xlviii
- Cutting clover, time for ... 86
- Cut worms, how to deal with ... 140
- Dairy interests of Saginaw Valley, by Hon. Wm. L. Webber ... 9
  - paper on by Geo. St. Clair ... 117
  - products, premiums on at State Fair ... 284
- Dean, A. J., election as Treasurer State Agr'l Society ... 260
- Decoction of tobacco on insects ... xli
- Deep setting for milk ... 119
- Debt for farmers ... 190
- Department of Horticulture, bulletin on Tomatoes ... 233
  - reports ... xvii
- Discussion on Clay soils or Sandy soils ... 71
- Detroit offer, to secure permanent location of State Fair ... 256
- Development in Farming discussed ... 55
- Devons, premiums at State Fair ... 264
- Diagonal roads, utility of ... 151

PAGE.

- Diameter of trees in College arboretum 252
- Diehl Mediterranean Wheat, notes on 229-232
- Disbursement account Agricultural College viii
- Discrimination in freight rates 19
- Discussion, butterine and oleomargarine 122
  - of permanent pastures 92
  - on potato growing 110
    - relative merits of breeds of cattle 114
    - school system 204
- Distance apart for peach trees 132
- Distribution of seeds by birds 251
- District schools, paper by Joshua Van Hoosen 201
- Districts, large or small 201
- Ditches compared with tile drains 173
- Diversities in nature, paper by Robt. Ure 182
- Dodge, Wm. E., on Industrial Education 48
- Donations to Botanical Department xlvi
  - Farm Department xxiii
  - Horticultural Department xxx
  - Library lxix
    - of newspapers lxxiv
- Draft horses, premiums on at State Fair 270
- Drainage by wells 168
  - of muck swamps, paper by Prof. R. C. Carpenter 154
    - soils affecting their temperature 154
  - necessity of for peaches 130
- Drained marshes, treatment of, paper by W. Asa Rowe 175
  - swamp field, cropping of at Agricultural College 160
- Drawings, premiums on at State Fair 287
- Dress parade at Agricultural College lxvii
- Drill at Agricultural College lxvii
- Dry rot in potatoes, by A. A. Crozier 103
- Dwarf Orangefield tomato described 239
  - Prolific tomato described 239
- Early Oakley wheat, notes on 228 and 231
- East Saginaw Institute 7
- Economic statistics of Michigan 25
- Educational Labor at Agricultural College xxviii
- Education for farmers, by Mrs. J. C. Wilson 192
- Egyptian wheat, notes on 229
- Election of Officers State Agricultural Society 260
- Embroidery Premiums at State Fair 290
- Emery tomato described 241
- Empire Superphosphate Fertilizer analyzed 248
- Emulsion of carbolic acid, effect on plants xxxix
  - kerosene and milk, paper by Prof. A. J. Cook 138
- Engineering Department, annual report xlviii
- English cow grass 89
  - draft horses, premium at State Fair 270
  - Report of Professor of lxiii
  - School of Landscape Gardening 60
- Enlargement of Apiary, reasons for xxxiv
- Entries for State Fair, time limit for 258
- Equipment of Mechanical Department xlix
- Essex Round Red Smooth tomato described 240
  - Swine, premium at State Fair 276
- Estabrook, Jno. S., address at East Saginaw Institute 8

PAGE.

- Estimates for water-works, liii
- European appropriations for agriculture, 218
- Evolution in farming by J. H. Peabody, 53
- Exchange list of library, lxxi
- Executive Committee State Agricultural Society, 254
  - meeting of, 255
- Exhaustion of Soils, 216
  - paper by H. A. Ladd, 73
- Exhibit at State Fair of Botanical Department, xliii
- Expenditures, Agricultural College, viii
- Experiments of Farm Department, xxiii
  - Zoological Department, xxxviii
  - on sources of nitrogen by Dr. R. C. Kedzie, 95
  - with carbolic acid emulsion, xxxix
    - Paris green, xl
    - Turpentine emulsion, xl
- Ex-presidents, State Agricultural Society, 254
- Factory prices for milk, 118
- Faculty of Agricultural College, v
- Fair, State, list of Premiums at, 263
- Fancy work, premiums on at State Fair, 289
- Farm, can the average one be made profitable? Paper byJ. J. Snook, 41
  - Department of Agricultural College, accounts of, viii
    - experiments on, xxiii
      - varieties of wheat, 227
    - report of superintendent, xxi
  - poetry of the, by Mrs. H. E. Bailey, 14
  - success on the, paper by Hon. Wm. Ball, 38
  - wages in Michigan, 27
- Farmers' Club, Ingham Co., paper on peat soils by W. Asa Rowe, 175
  - Education, paper by Mrs. J. C. Wilson, 192
  - Institute at East Saginaw, 7
    - Grass Lake, 10
    - Hudsonville, 1
    - Quincy, 11
    - Rochester, 2
    - St. Louis, 4
    - Series of for 1886, 1
  - Legal advice to, paper by Judge W. S, Tennant, 17
  - Organizations and Public Policy, paper by Robt. Alward, 29
  - Relations to Capital and Labor, paper by Hon. C. V. R. Pond, 20
    - Oleomargarine and Butterine, 122
  - Social rank of, paper by Hon. M. D. Campbell, 188
  - wife may be a lady, paper by Mrs. E. W. Treat, 185
- Farming, evolution in, paper by J. H. Peabody, 53
  - improvements in discussed, 56
  - on light soils, paper by C. L. Hall, 70
  - style in, paper by Prof. L. H. Bailey, Jr., 56
- Fat cattle, premiums on at State Fair, 267
  - hogs, premiums on at State Fair, 277
  - sheep, premiums on at State Fair, 275
- Feeding cattle, loss in stinting, 115
- Feejee tomato described, 241
- Fences of pine stumps, 6
- Fertility of soils, loss of, paper by H. A. Ladd, 73
  - maintenance of, 217
- Fertilizers, commercial, expense of, 70
  - money value of, 93

PAGE.
Fine arts, premiums on at State Fair 287
  wool sheep, premiums on at State Fair 273
Flies in the house, Buhach for 137
Flour, meal, etc., premiums on at State Fair 283
Foliage, effect of ashes on xli
  carbolic acid on xl
Foreign appropriations for agricultural purposes 218
  exchanges with Agricultural College Library lxxi
  periodicals in Agricultural College Library lxxii
Forests of Michigan described 181
Forest trees, bulletin on growing of, by Dr. Beal 250
Forfeitures of land grant lands since 1867 xii
Formation of muck swamps 157
  sandstone rock 145
Four important insecticides, paper by Prof. A. J. Cook 133
Fox, Mrs. T. B., paper on practical culture for farmers 196
French appropriations for agricultural purposes 218
  draft horses, premiums on at State Fair 270
  upright tomato described 243
Freight rates, discriminations in 19
Fuel, classification of wood for liii
Fulton Market tomato described 239
Fungus causing potato rot 106
Furniture, premiums on at State Fair 286

G.

Galloways, premiums at State Fair 265
Garden City Superphosphates Analyzed 248
  Department Agricultural College, accounts of ix
    annual report xxvii
    bulletin on tomatoes 233
    President Willits on xiv
Gas lime as an insecticide xli and 138
Geddes, David, paper on Advantageous Working of Light Soils 65
General Grant tomato described 239
Genoese Wheat 229
Geology for Farmers 194
  industrial 142
Georgia, red clover in 84
Gerber and Sons, Michigan Fertilizer Analyzed 248
Giant Clover, by Dr. W. J. Beal 89
Godfrey, Dr., on green storage of clover 91
Golden Queen tomato described 242
  Trophy tomato described 242
Gold not to be found in Lower Michigan 147
Grade Cattle, Premiums on at State Fair 266
Graded Schools for Country Districts 206
Grading for Landscape Effect, excess in 61
Graduates of Public Schools, admission of to Agricultural College xvii
Grain, cost of raising in Michigan 25
Grains and Seeds, premiums at State Fair 281
Grange, Prof. E. A. A., annual report lxvi
  paper on Veterinary Science and Agriculture 125
Granges and Public Policy, by Robt. Alward 29
Grants of Public Land, extravagant 32
Grass Lake Institute 10
Green, curing of clover 91
  Gage tomato described 242
  Manuring, value of 68

	Page.
Ground bone analyzed	248
Growing Forest Trees—bulletin by Dr. Beal	250
Growth of trees in College arboretum	252

H.

Hall, C. L., paper—Farming on Light Soils	70
Hathaway tomato described	240
Hay, clover, green storage of	91
time to cut	86
Height of trees in College arboretum	252
Henderson's Extra Selected Trophy tomato described	240
Herefords and Shorthorns compared	114
premiums on at State Fair	264
Highways, construction of, paper by T. Appleton, C. E.	151
law as to cattle running at large in	18
Hilling up potatoes as a remedy for rot	108
Holsteins, premiums at State Fair	266
Homestead Superphosphate, analysis of	248
Honey, bees, etc., premiums at State Fair	285
Horses, premiums on at State Fair	267
Horticultural Department, Agricultural College accounts of	ix
annual report	xxvii
bulletin on tomatoes	233
remarks of Prest. Willits on	xiv
Society, Botanical Department at meeting of	xlvi
House flies, buhach for	136
Hoven in cattle, how to avoid	89
How shall we improve our common cattle—paper by Edwin Phelps	112
Hubbard's Curled Leaf tomato described	238
Hudsonville Farmers' Institute	1
Humus in the natural condition	97
Hundred Days tomato described	239

I.

Ice houses for farmers	118
Improved Large Yellow tomato described	242
Improvement of muck swamps, by R. C. Carpenter	154
Improvements in farming	55
Income of Agricultural College since foundation	xv
Indebtedness, evils of for farmers	190
to inventors, paper by Prof. Lewis McLouth	208
Indian Imported Wheat, notes on	229
India rubber goods, premiums State Fair	286
Individual Teaching	203
Industrial Geology, paper by Prof. A. J. Cook	142
Schools in the Eastern States, report on	lv
Training for Women	lxii
Inert and active nitrogen	96
Ingham County Farmers' Club, paper on Peat Soils, by W. Asa Rowe	175
Insecticides, paper on, by Prof. A. J. Cook	133
Various	xli
Insoluble Phosphoric Acid in Commercial Fertilizers	249
Inspection of Commercial Fertilizers	245
Institute, Farmers', at East Saginaw	7
Grass Lake	10
Hudsonville	1
Quincy	11

PAGE.
Institute, Farmers', at Rochester ... 2
St. Louis ... 4
Series of for 1886 ... 1
Interest Fund Agricultural College ... xiii
International Superphosphate analyzed ... 248
Inventors, our Indebtedness to, paper by Prof. Lewis McLouth ... 208
Inventory Agricultural College, of cattle ... xxv
Summary of ... x
Island Beauty tomato described ... 240
Islands of Michigan ... 181
Italian gardening ... 60

J.

Jackson's offer to secure State Fair permanently ... 256
Jarvis Drill Phosphate ... 248
Jerseys, premiums at State Fair ... 265
Johnson, Prof. Samuel, annual report ... xxi
Bulletin on Varieties of Wheat ... 227
Paper on Needs of Agriculture ... 43

K.

Kalamazoo's offer to secure permanent location of State fair ... 256
Kansas, red clover in ... 83
Kedzie, Dr. R. C., annual report ... xxxii
on commercial fertilizers ... 70, 93
Bulletin ... 245
sources of nitrogen in plants ... 93
Kerosene Emulsion, by Prof. A. J. Cook ... 138
Experiments with ... xxxviii
how to make ... 140
on squash bug ... xxxix
King Humbert tomato described ... 242

L.

Labor and Capital, Farmers' Relation to, paper by Hon. C. V. R. Pond ... 20
what determines wages of ... 22
Ladd, J. H., paper on soil exhaustion ... 73
Ladies at Industrial Schools ... lxii
Lady, definition of ... 185
farmer's wife may be, paper by Mrs. E. W. Treat ... 185
Land grant, record of sales and forfeitures from 1867 ... xii
sales in 1886 ... xiv
Lands of U. S. grant vacant, by counties ... xiv
Excessive grants of ... 32
Landscape Gardening for Farmers ... 58
Lansing, offer to secure permanent location of State Fair ... 256
Large or small school districts ... 201
Red Smooth Round tomato described ... 239
smooth tomato described ... 269
Yellow Tomato described ... 242
Lathes in machine shop ... xlix
Law as to cattle at large ... 18
for farmers, paper by Judge W. S. Tennant ... 17
inspection of commercial fertilizers ... 245
Leather goods, premiums at State fair ... 286
Leaves sleeping, by Dr. Beal ... 80
Legal advice to Farmers, paper by Judge W. S. Tennant ... 17

PAGE.
Leguminosae family 77
Leicester sheep, premiums at State Fair 274
Lessons on growing forest trees 250
Lester's Perfected tomato described 241
Let the Secret Out, poem by Mrs. L. E. Cannon 184
Librarian's report lxix
Light soils; how worked advantageously, paper by David Geddes 65
  discussion by Pres. Willits 221
  farming on, paper by C. L. Hall 70
Lime for potato rot 108
  gas as insecticide 138
List of market peaches for Michigan 131
  premiums at State Fair 263
Little things in agriculture 45
Live stock, improvement of, by Edwin Phelps 112
Livingston's Beauty tomato described 241
  Favorite tomato described 240
  Perfection tomato described 241
Local Society report 294
Locating committee State Agricultural Society 257
Lockwood, Lieut. J. A., annual report lxvii
London purple for insects 134
Loss of fertility, by H. A. Ladd 73
Lycopersicum Pimpinelli folium 243
Lycopersicum Esculentum, synopsis of 237

M.

MacEwan, Prof. E. J., annual report of lxiii
Machines in workshops xlix
Mammoth clover, by Dr. Beal 89
Manual labor, educational xxviii
  illustrative xxix
  training schools, report on lv
Manufactured goods, premiums at State Fair 286
Marketable products from manual training schools lix
Market Champion tomato described 240
  peaches for Michigan 131
Marshes after drainage, treatment of 175
Marsh lands, Improvement of, paper by Prof. R. C. Carpenter 154
Martin's Amber wheat, notes on 227, 231, 232
Massachusetts Institute of Technology lviii
Mathematics, report of Professor xlviii
Mayflower tomato described 241
McGhee's wheat, notes on 229
  White wheat, notes on 230, 232
McLouth, Prof. Lewis, annual report lv
  report on eastern technical schools lv
  paper on inventors and mechanics 208
Mechanical building, picture of xlviii
  department, equipment of xlix
  needs of xli
  President Willits on xviii
Mechanics, Our Indebtedness to, paper by Prof. Lewis McLouth 208
Members Executive Committee State Agricultural Society 254
Mercantile method in manual training school lx
Merino sheep, discussion by Hon. Wm. Ball 40
  premiums at State Fair 272

PAGE.

- Merrell, M. J. C., annual report lxix
- Merritt, Prof. W. H., paper on peaches for profit 128
- Michigan, acreage of 179
  - Agricultural College, remarks on by President Willits 215
  - see Agricultural College.
  - Carbon Works, analysis of fertilizers 248
  - economic statistics 25
  - farm wages in 27
  - Fertilizer analyzed 248
  - geology, by Prof. A. J. Cook 142
  - islands 181
  - teachers' idea of size of 207
  - wilderness, paper by Geo. H. Cannon 178
- Mikado tomato described 213
- Milch cattle, care of 117
- Military Science, Report of Prof. of lxvii
- Milk, factory prices for 118
  - temperature for raising cream 119
  - yield of butter per cwt 118
- Miscellaneous articles, premiums on 292
- Mississippi, red clover in 83
- Mixed Husbandry, by Hon. Wm. Ball 39
- Morse, Hon. C. H., address at St. Louis 4
- Moths in Carpets 225
- Muck, properties of 157
  - soil, cold or warm 158
  - soils, treatment of, paper by W. Asa Rowe 175
  - swamps, improvement of, paper by Prof. R. C. Carpenter 154
  - temperature affected by drainage 158
- Museum, donations to xxxv
- Music, poem by Mrs. Cannon 200

N.

- Narrow-tired wagons, evils of 154
- Nature, diversities in, paper by Robt. Ure 182
- Naval Academy, report on lvi
- Needle-work, premiums at State Fair 289
- Needs of Agriculture, paper by Prof. Sam'l Johnson 43
  - Machine shop li
  - Mechanical Department lxi
- Nellis' Selected Trophy tomato described 240
  - Snowball tomato described 242
- New Cardinal tomato described 240
  - Red Apple tomato described 240
  - White Apple tomato described 242
- Newspapers donated to library lxxiv
- New York market tomato described 239
  - Trades School lvi
  - Workingman's School lvi
- Nisbit's Victoria tomato described 243
- Nitrogen of plants, sources of, paper by Prof. R. C. Kedzie 93
  - in commercial fertilizers 249
- Norman Percherons, premiums at State Fair 270
- Northwestern Fertilizing Co's. goods analyzed 248
- Norton, Hon. John N., remarks of 3

O

- Oakley wheat, notes on 228

PAGE.
Oats, cost of raising, in Michigan 26
Occupations of University and Agricultural College graduates 49
Officers of Agricultural College v
  salaries of ix
  State Agricultural Society 254
Oleomargarine and butterine 119
  what shall farmers do about it, paper by Charles Adams 119
  chemical composition of 120
Open ditches compared with tile 173
Orangefield tomato described 239
Organization of Farmers, by Robert Alward 29
Ornamental trees, too many about house 64
Our Common Schools, paper by Joshua Van Hoosen 201
  Indebtedness to Inventors, lecture by Prof. Lewis McLouth 208

P

Paintings, etc., premiums at State Fair 287
Pamphlets donated to Library lxxi
Paragon tomato described 241
Paris Green as an insecticide, by Prof. A. J. Cook 134
  experiments with xl
  for codling moths xli
Pastures, permanent or re-seeded, discussed 92
Patent question, remarks on, by Edwin Willits 213
Patrons of Husbandry, by Robt. Alward 29
Peabody, J. H., paper on evolution in farming 48
Peaches, climatic limit of 129
  drainage for 130
  for Profit, paper by Prof. W. H. Merritt 128
Pear-shaped tomato described 243
Peat Swamps, improvement of, paper by Prof. R. C. Carpenter 154
Peaty soils after drainage, paper by W. Asa Rowe 175
Pea vine clover 89
Percheron horses, premiums at State Fair 270
Perfection tomato described 241
Periodicals, American in Agricultural College Library lxxiii
  foreign in Agricultural College Library lxxii
Permanent location of State Fair, vote on 256
  pastures, discussion on 92
Persian tomato described 242
Pessell, Pres. H. D., address at Quincy 12
Phelps, Edwin, paper on improving common cattle 112
Phosphoric acid in commercial fertilizers 249
Phosphates, commercial, analysis of 248
Pickles, premiums on at State Fair 284
Picture of Botanical Laboratory xliv
  Mechanical building xlviii
Picturesque gardening 60
Pine stump fences discussed 6
  lands, value of, discussed 6
  trees not desirable near dwellings 65
Plant lice, kerosene emulsion for 138
Plants, sources of nitrogen of, by Dr. Kedzie 93
Plaster and clover for reclaiming exhausted soils 74
  quantity of to sow per acre 100
Plowing under clover, best time for 90
  green crops, value of 68

PAGE.

- Poetry of the farm, by Mrs. H. C. Bailey ... 14
- Poison on apple trees, is it dangerous? ... 135
- Poland-China Swine, premiums at the State Fair ... 277
- Polled Angus, premiums at State Fair ... 265
- Pond, Hon. C. V. R., paper on Capital and Labor ... 20
- Potash in commercial fertilizers ... 249
- Potato, Hop and Tobacco Superphosphate, analyzed ... 248
  - growing, discussion on ... 110
  - rot, paper on, by A. A. Crozier ... 103
- Poultry, premiums at State Fair ... 278
- Practical Culture, paper by Mrs. T. B. Fox ... 196
  - Education, paper by Prof. Saml. Johnson ... 47
- Precursor tomato described ... 239
- Premium list State Fair ... 263
- President Willits' report ... xvii
  - talks on the Agricultural College ... 215
- Preston, E. M., donations by ... xxxvi
- Price for teachers ... 207
- Prices for milk at factory ... 118
- Private tutors, value of ... 203
- Prize Bell tomato described ... 240
- Progress in farming discussed ... 55
- Profit on the average farm, paper by J. J. Snook ... 41
- Programs of Institutes ... 1 to 11
- Prout, John, paper on efficacy of different manures ... 67
- Public lands, excessive grants of ... 32
  - policy and farmers' organizations, paper by Robert Alward ... 29
  - schools, paper by Joshua Van Hoosen ... 301
- Pulse family of plants, description of ... 77
- Pure ground bone fertilizer, analyzed ... 248
- Pyrethrum as an insecticide ... 136
  - experiments with ... xli

Q

- Queen City superphosphate analyzed ... 248
  - tomato described ... 240
- Quincy Institute ... 11

R

- Radish maggot and carbolic acid emulsion ... xxxix
  - kerosene emulsion ... xxxviii
- Railroads, excessive grants of public lands to ... 32
- Rank of farmers socially, Hon. M. D. Campbell ... 188
- Read's Island Beauty tomato described ... 240
- Receipts of Agricultural College on current account ... vii
  - on account of special appropriations ... vi
- Reclamation of exhausted soils ... 74
- Red Cherry tomato described ... 242
  - clover, paper by Prof. W. J. Beal ... 76
  - streak in potatoes discussed ... 110
  - Valencia Cluster tomato described ... 240
- Relation of Veterinary Science to agriculture ... 123
- Relative profit of blooded and common cattle ... 113
- Remedies for potato rot ... 107
- Repairs of buildings, report on ... lii
- Report of Alpena County Agricultural Society ... 294
  - Chemical department ... xxxii
  - department of Mechanics and Astronomy ... lv

PAGE.
Report of Librarian lxix
  President Willits xvii
  Professor of Agriculture xxi
    Botany and Forestry xlii
    English lxiii
    Horticulture xxvii
    Mathematics xlviii
    Military Science lxvii
    Veterinary Science lxvi
    Zoology xxxiii
Report of stock sale at College xxiv
  on analysis of commercial fertilizers 245
    eastern technical schools lv
    repairs of buildings lii
    steam works lii
    State Agricultural Society 254
Repton as a teacher of landscape gardening 60
Reseeding pastures discussed 92
Reverted phosphoric acid in commercial fertilizers 249
Rhetorical work at Agricultural College lxiv
Richardson, Hon. Geo. F., on butterine legislation 36
Roads and road making, paper by T. Appleton, C. E. 151
  utility of diagonal 151
Roadsters, premiums on at State Fair 269
Rochester Institute 2
  tomato described 241
Rocks, formation of 143
Rogers' Amber wheat, notes on, as grown at Agricultural College 227, 231
Roots and vegetables, premiums at State Fair 282
Rose Chafer, buhach for 136
  slug and kerosene emulsion xxxviii
Rot in potatoes, paper by A. A. Crozier 103
  tomatoes, varieties subject to 244
Round Red tomato described 239
Rowe, W. Asa, paper on treatment of drained marshes 175
Rubber goods, premiums on at State Fair 286

S.

Saginaw county, wheat culture in, paper by Dennis Bow 101
  Dairy Interests, paper by Hon. Wm. L. Webber 9
  Valley, statistics of 8
Saint Louis Farmers' Institute 4
Salable products from manual training workshops lix
Salaries, Agricultural College ix
Sale of stock at College xxiv
Sales and forfeitures of Agricultural College lands since 1867 xii
  of Agricultural College lands in 1886 xiv
Salt deposits of Michigan, origin of 150
Sandstones, formation of 145
Sandy lands of Michigan, value discussed 6, 221
  soils or clay, relative merits discussed 71
    farming on, paper by C. L. Hall 70
    how worked to advantage, by David Geddes 65
Scale lice, kerosene emulsion for 138
School districts, township plan 202
Schools, Our Common, paper by Joshua Van Hoosen 201
Scientific farming, need of 216
  paper by Mrs. J. C. Wilson 194

PAGE.
Scoville tomato described 241
Scrub cattle, loss in raising 112
Secretary's accounts, Agricultural College vi
Seedling volunteers in Agricultural College aboretum 251
Seeds, distribution of by birds 251
  premiums on at State Fair 282
Shade, evil of excessive about houses 62
Shorthorns and Herefords, compared 114
    premiums on at State Fair 263
Sheep for restoring exhausted soils 74
  premiums on at State Fair 272
  value of on the farm, by Hon. Wm. Ball 40
Shops at Agricultural College, needs for coming two years li
      picture of building xlviii
      report of Superintendent xlviii
      work in l
  for manual training, marketable products from lix
Sinclair, Geo., paper on the dairy 117
Size of Michigan, a teacher's idea of 207
  drain tile, paper by Prof. R. C. Carpenter 171
Sleep of leaves, by Prof. W. J. Beal 80
Small schools, advantages of 203
Snook, J. J., paper—Can the average farm be made profitable? 41
Social rank of farmers, paper by Hon. M. D. Campbell 188
      remarks by Robt. Alward 28
Soil exhaustion, paper by H. A. Ladd 73
Soluble phosphoric acid in commercial fertilizers 249
Sources of Nitrogen in plants, paper by Dr. R. C. Kedzie 93
Souring of clover plowed under 91
Southdown sheep, premiums at State Fair 273
Special appropriation account, expenditures at Agricultural College viii
      receipts at Agr'l College vi
      statement for 1885-6 xvi
      since foundation of Agricultural College xv
Spraying apple trees with poison 135
Squash bugs and kerosene xxxix
Standard of admission at Agricultural College xvii
Standing committees of State Agricultural Society 255
Starving animals fat, loss in attempting 115
State Agricultural Society, annual report of 254
      executive committee 254
          meeting 255
        superintendents 255
      Ex-Presidents of 254
      meeting of locating committee 257
      minutes of fair meetings 258
      officers 254
      premium list 263
      standing committees 255
State Board of Agriculture, members of iv
State Fair, botanical exhibit at xliii
    premium list 263
    time limit for entries 258
Statement of account with special appropriations for '85–'86 xvi
Steam dredge for ditching swamps 167
  works at Agricultural College, report on lii
Steaming of clover hay 92
Sterling, J. C., Election as Sec'y State Agr'l Society 260

PAGE.

- Stevens Institute of Technology, report on lvii
- Stinting feed of animals, loss in 115
- Stock, improvement of common, paper by Edwin Phelps 112
  - running at large 18
  - sale at Agr'l College xxiv
- Straw culture of potatoes 111
- Stubble of clover, amount per acre 81
- Student labor at Agr'l College, accounts of, for 1886 xv
  - in shops l
  - on Horticultural Department xxviii
- Students' sets of tools at Agr'l College xlix
- Stump land, value of, discussed 6
  - puller described 7
- Stunting animals, loss in 115
- Style in Farming, paper by Prof. L. H. Bailey, Jr. 56
- Success on the Farm, Hon. Wm. Ball 38
- Suffolk swine, premiums at State Fair 276
- Sugar, premiums on, at State Fair 284
- Sulphate of potash in commercial fertilizers 241
- Sulphur for potato rot 107
- Summary of inventory Agr'l College x
  - resources of Agr'l College xi
- Superintendent of Farm, annual report xx
  - Garden, annual report xxvii
  - Shops, annual report xlviii
- Superintendents of departments State Agr'l Society 255
- Superphosphate, commercial, analysis of 248
- Surprise wheat, notes on 229, 230, 232
- Swamp land grant, balance remaining of xi
  - sales from, since granted xv
- Swamps, treatment after drainage, paper by W. Asa Rowe 175
  - improvement of, paper by Prof. R. C. Carpenter 154
- Sweating of clover hay 92
- Swine, premiums on, at State Fair 276
- Synopsis of cultivated tomatoes 237

T.

- Teachers, pay of 207
- Teaching individually 203
- Technical schools at the east, report on lv
- Technology, Massachusetts Institute of, report on lviii
  - Stevens' Institute of, report on lvii
- Temperature of milk for raising cream 119
- Temperature of muck affected by drainage 158
- Temperature, minimum of, for peaches 129
- Tennant, Judge W. S., paper on Legal Advice to Farmers 17
- Tent caterpillars, Paris green for 135
- Thinning ornamental trees for beauty 62
  - peaches 132
- Thistles, Canada, how to kill, by J. S. Woodward 84
- Thoroughbred horses, premiums on at State Fair 267
- Tilden tomato described 241
- Tile drainage of muck land 161
  - drains, construction of 165
  - how to determine size necessary 163
  - size of, paper by Prof. R. C. Carpenter 171
- Time to cut clover 86

PAGE.

Tires, narrow or wide, discussed 154
Tobacco as an insecticide xli
Toledo Manual Training School, report on lv
Tomatoes, bulletin on by Prof. Bailey 233
  method of training 234
  synopsis of cultivation of 237
  varieties subject to rot 244
Tomato rot 235
Tom Thumb tomato described 238
Tools, student's sets at Agricultural College xlix
Township school trustees 201
Trades School, New York lvi
Training tomatoes, Methods of 234
Transportation question, legal aspects of 18
Treasurer's report, Agricultural College vii
Treat, Mrs. E. W., paper, Farmer's Wife May be a Lady 185
Tree tomato described 243
Trees, growing of forest 250
  too many about a house 64
Trefoil described 76
Trifles, importance of in agriculture 45
Trifolium medium, by Prof. W. J. Beal 89
  pratensae, paper by Prof. W. J. Beal 76
Trophy tomato described 240
Trust fund Agricultural College xiii
Turner Hybrid tomato described 243
Turpentine emulsion, experiments with xl
Tutors, private, value of 203
Twenty-Six Dollar Phosphate analyzed 248
Tyranny of Capital discussed 21

U.

Undergrowth in College Arboretum 251
United States land grant, interest from xiii
  sales and forfeitures from 1867 xii
  Naval Academy, report on lvi
University and Agricultural College graduates compared 49
Unleached ashes on insects and foliage xli
Upright tomato described 243
Ure, Robert, paper on diversities of nature 183

V.

Vacant Lands of College Grant, by counties xiv
Value of Pine Stump Land 6
Varieties of Peaches for Michigan 130
  Tomatoes, bulletin on 233
  Wheat on College Farm 227
Vegetable Bone Superphosphate analyzed 248
Vegetables, premiums at State Fair 282
Veterinary Science and Agriculture, Paper by Prof. E. A. A. Grange 123
  foreign appropriations for 220
  Report of Professor of lxvi
Vick's Criterion tomato described 242
Views in Landscape Gardening, how to develop 59
Virginian exhausted soils 216
Vistas in Landscape Gardening, how to develop 59
Voelcker, Dr., on agricultural value of clover 82

W.

PAGE.

- Wages of Farm Laborers in Michigan 27
    - Teachers 207
    - what determines rate of 22
- Wagon wheels, narrow or wide 154
- Washington, exhaustion of soil near 222
- Water-Works, estimates for liii
- Wealth, affecting social standing of Farmers 190
- Webber, Hon. Wm. L., Dairy Interests of Saginaw Valley 9
- Well Draining 168
- Western Union Chemical Co.'s Fertilizers analyzed 248
- Wet rot in Potatoes, paper by A. A. Crozier 103
- What shall we do with Drained Swamps, by W. Asa Rowe 175
    - can women do? poem by Mrs. L. E. Cannon 199
- Wheat, bulletin on varieties on College farm 227
    - cost of raising in Michigan 25
    - cultivating of 102
    - culture in Saginaw county, paper by Dennis Bow 101
    - raising in Michigan discussed 43
- When to cut clover 86
    - plow under clover 90
- White Apple tomatoes described 242
    - arsenic for insects, by Prof. A. J. Cook 134
    - Australian wheat, notes on 229, 232
- Wide-tired wagons, value of 154
- Wife of farmer may be a lady, Mrs. E. W. Treat 185
- Wilds of Michigan, paper by Geo. H. Cannon 178
- Willits, Pres. Edwin, discussion on light soils 221
    - on corporation legislation 36
        - mortgage taxation 38
        - small schools 202
    - remarks on Michigan Agricultural College 215
        - patent rights questions 213
    - report of xvii
- Wilson, Mrs. J. C., paper on book farming 192
- Winter killing of clover 85
- Women at Industrial Schools lxii
- Wood cut of Botanical Laboratory xliv
    - Mechanical building xlviii
    - for fuel, classification of liii
- Woodward, J. S., on killing Canada Thistles 84
- Woolly louse and kerosene emulsion xxxix
- Worcester Free Institute, report on lvii
- Workingman's School of New York lvi
- Workshops, machines in xlix
- Wysor Wheat, notes on 229-232

Y.

- Yellow Cherry tomato described 242
    - Plum tomato described 243
    - Victor tomato described 242
- Yorkshire swine, premiums at State Fair 276

Z.

- Zoological Department, annual report xxxiii
    - bulletin on carpet beetle 223
    - donations to xxxv
    - experiments by xxxviii
- Zoology for farmers 195

New York Botanical Garden Library
3 5185 00259 1350